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U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF EXPERIMENT STATIONS—BULLETIN NO. 164.

A. C. TRUE, Director.

PROCEEDINGS

OF THE

NINETEENTH ANNUAL CONVENTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS,

HELD AT

WASHINGTON, D. C., NOVEMBER 14-16, 1905.

EDITED BY

A. C. TRUE and W. H. BEAL, for the Office of Experiment Stations,

AND

H. C. WHITE, for the Executive Committee of the Association.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1906.

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North Carolina—*West Raleigh:* G. T. Winston.[a] *Greensboro:* James B. Dudley.[a]
North Dakota—*Agricultural College:* J. H. Worst.[a]
Ohio—*Columbus:* William Oxley Thompson.[a]
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[a] President.
[b] Principal.
[c] Acting president.
[d] Chancellor.

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U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF EXPERIMENT STATIONS—BULLETIN NO. 164.

A. C. TRUE, Director.

PROCEEDINGS

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WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1906.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Office of Experiment Stations,
Washington, D. C., January 15, 1906.

Sir: I have the honor to transmit herewith for publication Bulletin No. 164 of this Office, containing the proceedings of the nineteenth annual convention of the Association of American Agricultural Colleges and Experiment Stations held at Washington, D. C., November 14–16, 1905.

Respectfully,

A. C. True,
Director.

Hon. James Wilson,
Secretary of Agriculture.

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Bibliographer.

A. C. True, of Washington, D. C.

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C. R. Van Hise, of Wisconsin; H. C. Price, of Ohio, *Programme Committee.*

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H. P. Armsby, of Pennsylvania; C. F. Curtiss, of Iowa; M. A. Scovell, of Kentucky, *Programme Committee.*

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Extension Work.

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Experiment Station Organization and Policy.

For three years, **Eugene Davenport**, of Illinois, *Chair.*, and C. D. **Woods**, of Maine; for two years, W. A. **Henry**, of Wisconsin, and H. J. **Waters**, of Missouri; for one year, M. A. **Scovell**, of Kentucky, and C. E. **Thorne**, of Ohio.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Alabama: C. A. Cary, J. F. Duggar, R. S. Mackintosh, C. C. Thach, C. C. Thach, jr.

Arizona: K. C. Babcock.

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Nevada: P. B. Kennedy, J. E. Stubbs.

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New Mexico: L. Foster, R. F. Hare, W. G. Tight.

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North Dakota: E. F. Ladd, W. Merrifield, J. H. Worst, Mrs. J. H. Worst.

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Wisconsin: E. H. Farrington, G. N. Knapp, E. P. Sandsten, H. C. Taylor, C. R. Van Hise.

Wyoming: B. C. Buffum, F. M. Tisdel.

United States Department of Agriculture: W. M. Hays, Assistant Secretary; E. W. Allen, W. H. Beal, D. J. Crosby, W. H. Evans, J. Hamilton, C. F. Langworthy, H. W. Lawson, J. B. Morman, J. I. Schulte, C. B. Smith, A. C. True, and E. V. Wilcox, of the Office of Experiment Stations; E. G. Ritzman and G. M. Rommel, of the Bureau of Animal Industry; W. D. Bigelow, C. C. Moore, L. S. Munson, A. Seidell, W. W. Skinner, F. P. Veitch, P. H. Walker, and H. W. Wiley, of the Bureau of Chemistry; E. S. G. Titus, of the Bureau of Entomology; C. R. Ball, T. D. Beckwith, J. S. Cates, L. C. Corbett, L. G. Dodge, B. T. Galloway, K. F. Kellerman, C. V. Piper, G. H. Powell, T. R. Robinson, C. L. Shear, W. A. Taylor, W. W. Tracy, sr., J. M. Westgate, and C. F. Wheeler, of the Bureau of Plant Industry; T. M. Bell, J. O. Belz, F. E. Bonsteel, J. A. Bonsteel, F. K. Cameron, O. L. Eckman, G. H. Failyer, L. C. Holmes, C. A. Jensen, B. E. Livingston, M. H. Lapham, G. B. Maynadier, J. W. Nelson, F. R. Pember, O. Schreiner, J. G. Smith, F. D. Stevens, W. C. Taber, and M. Whitney, of the Bureau of Soils.

Bureau of Education: L. A. Kalbach.

Canada: G. C. Creelman, H. H. Miller, J. C. Readey.

CONSTITUTION OF THE ASSOCIATION.

NAME.

This association shall be called the Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the association, and to secure to that end mutual cooperation.

MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department shall be eligible to membership in this association.

(2) Any institution a member of the association in full standing may send any number of delegates to the meetings of the association. The same delegate may represent both a college and a station, but shall vote in only one section and shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified divisions of the sections of the association, but such delegates shall vote only in such divisions, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture or mechanic arts who shall attend any convention of this association may be admitted to similar privileges.

SECTIONS.

(1) The association shall be divided into two sections: (a) A section on college work and administration; (b) a section on experiment station work.

The section on college work and administration shall be composed of the presidents or acting presidents of colleges and universities represented in the association, or other representatives of such institutions duly and specifically accredited to this section, and no action on public and administrative questions shall be final without the assent of this section.

The section on experiment-station work shall be composed of the directors or acting directors of experiment stations represented in the association or of other representatives of such stations duly and specifically accredited to this section.

(2) Members of these two sections (and no others) shall be entitled to vote both in general sessions and in the section to which they respectively belong.

The representative appointed by the U. S. Bureau of Education shall be assigned to the section on college work and administration; the representative of the Office of Experiment Stations to the section on experiment-station work, and the representative of the U. S. Department of Agriculture to either section as he may elect and the section by vote authorize; but such election once made and authorized may not be changed during the sessions of a given convention.

Each section may create such divisions as it may from time to time find desirable, and shall elect its own chairman and secretary for sectional meetings, whose names shall be reported to the association for record.

(3) Each section shall conduct its own proceedings, and shall keep a record of the same, and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the association in general session, and in the case provided for in the foregoing paragraph (1) shall also have been approved by the section on college work and administration.

MEETINGS.

(1) This association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the association. Special meetings may be held at other times, upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the programme. Unless otherwise determined by vote, the association will meet in general session in the forenoons and evenings of the convention and the sections in the afternoons.

OFFICERS.

(1) The general officers of this association, to be chosen annually, shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer, and an executive committee of five members, three of whom shall be chosen by the section on college work and administration and two by the section on experiment station work: *Provided, however,* That a member chosen by either section need not be a member of that section. The executive committee shall choose its own chairman.

(2) Each section shall, by ballot, nominate to the association in general session for its action, a chairman and a secretary for such section.

(3) The president, vice-presidents, secretary, and bibliographer of this association shall be elected by ballot upon nomination made upon the floor of the convention, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the association, or an officer of an institution which is a member of the association in full standing at the time of election, shall be eligible to office.

DUTIES OF OFFICERS.

(1) The officers of the association shall perform the duties which usually devolve upon their respective offices.

(2) The president shall deliver an address at the annual convention before the association in general session.

(3) The executive committee shall determine the time and place of the annual conventions and other meetings of the association, and shall, between such conventions and meetings, act for the association in all matters of business. It shall issue its call for the annual conventions of the association not less than sixty days before the date on which they are to be held, and for special meetings not less than ten days before such date. It shall be charged with the general arrangements and conduct of all meetings called by it. It shall designate the time and place of the convention; it shall present a well-prepared order of business—of subjects for discussion—and shall provide and arrange for the meetings of the several sections. The subjects provided for consideration by each section at any convention of the association shall concentrate the deliberations of the sections upon not more than two lines of discussion, which lines as far as possible shall be related. Not more than one-third of the working time of any annual convention of the association shall be confined to miscellaneous business.

FINANCES.

At every annual convention the association, in general session, shall provide for obtaining the funds necessary for its legitimate expenses, and may, by appropriate action, call for contributions upon the several institutions eligible to membership; and no institution shall be entitled to representation or participation in the benefits of the association unless such institution shall have made the designated contribution for the year previous to that in and for which such question of privilege shall arise, or shall have said payment remitted by the unanimous vote of the executive committee.

AMENDMENTS.

This constitution may be amended at any regular convention of the association by a two-thirds vote of the delegates present, if the number constitute a quorum: *Provided*, That notice of any proposed amendment, together with the full text thereof and the name of the mover, shall have been given at the next preceding annual convention and repeated in the call for the convention. Every such proposition of amendment shall be subject to modification or amendment in the same manner as other propositions, and the final vote on the adoption or rejection shall be taken by yeas and nays of the institutions then and there represented.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the programme.

(3) Speakers invited to open discussion shall be entitled to twenty minutes each.

(4) In general discussions the ten-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general programme shall be closely observed, unless changed by a two-thirds vote of the delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

(8) Vacancies which may arise in the membership of standing committees by death, resignation, or separation from the association, of members, shall be filled by the committees, respectively.

PROCEEDINGS OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

MINUTES OF THE GENERAL SESSION.

MORNING SESSION, TUESDAY, NOVEMBER 14, 1905.

The convention was called to order at 10 o'clock a. m., at the Shoreham Hotel, by the president, E. B. Voorhees, of New Jersey.

The proceedings were opened with prayer by W. H. S. Demarest, of New Jersey.

After the call of the roll of delegates to the convention, the regular order was suspended to give the Secretary of Agriculture opportunity to address the convention.

ADDRESS BY HON. JAMES WILSON, SECRETARY OF AGRICULTURE.

MR. PRESIDENT AND GENTLEMEN: I merely dropped in to pay my respects to you, and make you welcome to the capital city of our country, and bid you godspeed in your deliberations. I was first a station man before I was a department man, and know something about what it is to break new paths through the woods along these lines, and get the farmers to send their boys to college, and coax legislatures to be generous with the research men, and all that; and when I came down here—with a good deal of reluctance—to do something in the Department of Agriculture, my prevailing thought was that I would try to make that institution subservient to the stations of the country, and to help build them up. I found that it was necessary to first build the Department up; that it was not as strong in educated scientists as it should be; that there was not very much encouragement given to men of that class, and that it was difficult to find men to do the work the American farmer wants done, without a stronger force of trained men. We found it necessary to prepare to train within ourselves. There were so many things to be done that the universities and colleges of the land had not yet set about doing, that we have had to do a great deal along the line of strengthening the Department; and so I was compelled to turn my attention to that one thing and push it in all possible directions, to select strong men, and interview Congress occasionally for increased appropriations. We have been doing what we can. We have come to the place where I have been able to give some thought to the experiment stations of the country. Of course it is desirable that the whole should work together as a unit, that whatever the Department can do to strengthen a station anywhere it shall do, and that whatever cooperation can be had between the Department and the stations shall be had along lines that are broad and national in their effects. And then when it comes to the point of what the station can do for its own locality, I come up against the position that the stations are not strong enough to do all the work that their own localities require.

The Federal Government is not giving the station men money enough. They should have more endowment. We can find facilities for cooperation with every station in the land, and we are doing that with nearly every station in some regards, but the stations have not money enough to equip their staffs sufficiently for them to attend to all the requirements of their own people. The stations have a great deal compared with what they had some years ago. They have educated men, they have organizations, they have buildings, they are in touch with their people; but they have not got the wherewithal to do the work that the people in the several localities want done, with a very few exceptions. To that end I am preparing my report for Congress and I am earnestly urging upon Congress to give the stations more money to enable them to do their work. If we could only get that body of honorable gentlemen to comprehend how much good is coming to the American people from this research work, the undertaking would be already accomplished. Our poultry interests in the United States amount to over $500,000,000 a year, and it is growing, and I hope to live to see the day when the hen of the United States will pay all the expenses of the American Government. And when Congress meets all they will have to inquire into especially will be the price of eggs. I know of no investment that the American people can make that will bring back as great returns to them as the thorough equipment of the experiment stations in every State and Territory in the land. If you take the money that is given to the Department of Agriculture and the money that is given by Congress to you and put it all together, it would not build one battle ship. If they will just give us enough to build one battle ship every year for a while we will show them what that hen will do. The people want this work done, as I have learned. They want their stations provided for in better shape than they are now. Some of the States are coming up admirably to the requirements of the stations and colleges, and helping them along. Some are not. But Congress can; and when Congress appropriates money it is only the people's money; that is all it is. And it is only necessary now that we should lay our heads together and look to Congress for this assistance that is so much needed and work all together for it and I think it will come. Congress usually tells us that they must economize: "It has come to the time in the history of the United States when rigid, strict, economy must be practiced." There is no economy I can think of so far-reaching as investments of money to help the American farmer to make the most of his acres and of himself.

Gentlemen, I thank you very much. I shall take occasion to drop in and listen to your discussions, because I feel at home with you. And so I wish you good morning.

REPORT OF THE EXECUTIVE COMMITTEE.

H. C. White, of Georgia, chairman, submitted the following report of the executive committee:

Your executive committee, appointed at the eighteenth annual convention of the association held at Des Moines, Iowa, November 1–3, 1904, met immediately upon adjournment of the convention and organized by the selection of President H. C. White, of Georgia, as chairman. Acting under instructions of the committee the chairman issued and posted to each member of the association, under date of January 10, 1905, an abstract memorandum of the proceedings of the convention of 1904. The proceedings in full were edited by the chairman and placed in the hands of the Office of Experiment Stations, U. S. Department of Agriculture, for publication, February 25, 1905. Six subsequent meetings of the committee were held, as follows: At Washington, D. C., December 7–9, 1904; January 17–19, 1905; February 8–10, March 24–26, April 12–13, and November 13. Six circulars of information concerning the results of these meetings were issued and posted to members of the association. The call for the nineteenth (1905) annual convention was issued June 20, 1905, and the programme for the convention, as arranged by the committee, November 1.

In recognition of the courteous invitation of the State University of Oregon, "in behalf of the State of Oregon and the entire Northwest," to hold the nineteenth convention of the association in Portland, Oreg., during the Lewis and Clark Exposition, the committee entered into correspondence with the officers of the exposition and others in Oregon and the Northwest, but, after due deliberation, was convinced that it would be inexpedient to accept the invitation. It was likewise found inexpedient to accept a very cordial invitation to hold the convention at the University of Illinois at the time of the installation of President James in October. At the time the call was issued for the present meeting the committee was under the apprehension that an extra session of Congress would be called to convene somewhat earlier, in November.

The results of the attention given by the committee to the several matters referred to it in specific resolutions of the last annual convention have been, in the main, communicated to members of the association by appropriate circulars, and somewhat in detail. Copies of these circulars are hereto attached as part of the record of the work of the committee. Brief reference to these matters may, therefore, suffice at this time.

In an interview with the President of the United States your committee renewed the request that had been presented to him on a former occasion in behalf of the association, that, in the appointment to the post of Assistant Secretary of Agriculture, then vacant, he would be pleased to consider the desirability that the incumbent should be one having knowledge of and sympathy with the work of the agricultural experiment stations. Received most cordially by the President, your committee was informed that he had borne in mind the representations previously made to him and had decided to appoint to the position Prof. W. M. Hays, of the Minnesota Experiment Station. As is well known to the association, the appointee to this important and responsible position is an able worker in agricultural science and a distinguished member of this association.

After several conferences with the Secretary of War and the officers of the General Staff connected with the Army War College, very desirable modifications of the regulations governing the detail of army officers to the land-grant colleges were secured. These modifications were communicated to members of the association in a circular of date April 7, 1905, and are set forth in General Orders, No. 101, of the War Department, issued June 29, 1905; the committee trusts they may be satisfactory to the institutions concerned. The committee wishes to record here its grateful appreciation of the frankness, the cordiality, and the earnest desire to meet the wishes of the association with which the committee was met by the distinguished Secretary of War (Hon. W. H. Taft), the Chief of Staff (General Chaffee), and the officers of the War College.

The committee made diligent effort and employed every resource at its command, including personal solicitation of the Speaker and other influential members of the House of Representatives, to aid Hon. H. C. Adams of Wisconsin, in securing consideration for his bill to increase the annual appropriations to the experiment stations in the last session of the Fifty-eighth Congress, but without avail. So far as could be ascertained but little objection existed to the proposition on its merits, but other considerations were represented as preventing favorable action at the time. Mr. Adams, who continued and proposes to continue his able and energetic advocacy of the measure, expresses his intention to reintroduce it in the Fifty-ninth Congress (of which he is a member), to convene in December. The committee recommends that the executive committee be instructed to cooperate diligently with Mr. Adams in his efforts to secure increased annual appropriations from the Federal Treasury to the agricultural experiment stations established under the act of 1887.

Similar efforts were made by the committee in behalf of the measure of Hon. Frank W. Mondell, of Montana, to establish and maintain schools of mines and mining in connection with the land-grant colleges, with similar result, and, apparently, for similar reasons.

Your committee is forced to the conviction that the efforts of this association to bring the National Legislature to consider seriously the important measures affecting the national usefulness of the institutions here represented, should, in order to be effective, be concentrated at a given time upon a single purpose. There can be no doubt that the increasing prosperity and the increasing growth of industrial occupations throughout the country generally and the undertaking or the supervision by the General Government of great works of public utility, in which all the States and Territories are interested, such as the irrigation of our arid lands and the conservation of our forests, will create a demand for increased industrial and technical education and research, which, in equity, the individual States should not be expected to meet from their own resources, but for which provision should be made to the States from the National Treasury. It is inevitable, as it is right, that additional appropriations of Federal funds should be made to the land-grant colleges. In due season these claims should be made, and doubtless will be, and it will be the legitimate province of this association to initiate the appropriate measures for legislation. Such measures, when carefully prepared and judiciously presented, should be advocated with all the power and the influence of this association; but, in the opinion of the committee, experience suggests the wisdom of concentration of effort upon some single comprehensive, but definite, proposition, rather than an attempted support, necessarily weaker, at the same time, of several more specialized propositions, however meritorious these in themselves may be. This attitude of the association would not prohibit, of course, such indorsement as it might be moved to give to other specific measures affecting technical education and research initiated by wise statesmen or others. The mining-school bill has been before Congress for several sessions. It is an extremely meritorious measure and has a number of earnest advocates. If the association should so direct, no doubt arrangements may be made for the introduction of this or a similar bill in the next Congress. Your committee submits to the association, however, in view of the efforts which will be required in connection with the proposition which will be made to increase the appropriations to the experiment stations, whether it would not be wise to withhold for the present specific instructions to your executive committee in connection with the mining-school bill or similar measure, leaving the committee free to concentrate its efforts to secure the passage of the Adams bill, giving, of course, to the mining-school bill, if introduced, such support as may be practicable or conditions may justify. This done, the association might, and in the judgment of the committee should, make appeal to Congress for increased appropriations to the colleges for technical education in general, with greater hope of success.

Apropos of these suggestions the committee presents a communication received by it asking action by this convention in connection with a resolution adopted by the American Forest Congress held at Washington, D. C., January 2–6, 1905, urging appropriations by Congress "for promoting the teaching of forestry and experiments in forestry in the agricultural colleges and experiment stations of the United States."

The most delicate, and, in some respects, the most important task assigned your committee by the association at the last annual convention was embodied in the following resolution: "In order that Congress may be properly informed as to the work of the agricultural experiment stations and its great value to agricultural practice and to promote satisfactory relations between the Department of Agriculture and the experiment stations, the executive committee of this association is hereby instructed to request a hearing before the proper committees of Congress for the purpose of presenting the work and claims of the agricultural experiment stations, and to continue conferences with the honorable Secretary of Agriculture relative to cooperation between his Department and the stations." In obedience to these instructions your committee sought a hearing before the House Committee on Agriculture, which was granted at a special session, January 18, 1905, most kindly and courteously arranged for by the distinguished chairman of the committee, Hon. James W. Wadsworth, of New York. The published report of the hearing has been distributed to members of the association. It was distinctly understood that no argument was to be made for any pending measures. The Adams bill had already been favorably reported by the committee. Your committee was advised to restrict its showing to the "work of the agricultural experiment stations and its great value to agricultural practice." Director Jordan, of the committee, presented in writing an able and elaborate review of the work of the stations. At the suggestion of your committee the honorable Secretary of Agriculture, the Assistant Secretary, and other officials of the Department of Agriculture were present at the hearing.

As the members of the association clearly understand, it has been feared that there might be on the part of Congress a growing tendency to underestimate the stations as a factor in agricultural progress and to regard them as occupying a subordinate position in the field of agricultural research; consequently, after mature deliberation, it was decided that the proper course in carrying out your instructions was to deal with the broad questions of public benefit and public policy and seek to establish in the congressional mind a certain point of view as to the relative importance of the stations and as to the wise distribution of national aid to agricultural research.

The situation, as it impressed itself upon us, appeared to demand, therefore, the presentation of facts along two lines: (1) A somewhat comprehensive review in brief terms of what the stations had already accomplished for practical agriculture as a justification for enlarged support, and (2) a discussion of the policy that should be followed in the development of agricultural research in the United States, whether the prevailing one of centralization with an increase of funds for the National Department greatly out of proportion to the increase of the resources of the individual stations, thereby inevitably bringing the field of research, both general and local, more and more within the scope and direction of the National Department, with the consequent minimizing of station influence, or whether the maintenance of the resources of the stations in the several States more on a parity with the resources of the National Department, thus enabling these State institutions to sustain themselves as the leading instruments of research within their respective fields.

Your committee made the broad claim, which we believe to be abundantly justified by facts, that the stations have been and still are the most important existing factor in agricultural research, and strong ground was taken in favor of the proposition that these institutions are the logical, economical, and most efficient agency for the study of the agricultural problems which are important in their respective States. The published report of the hearing is, in the main, correct, although the spirit and language of the informal questions and answers are in some instances inaccurately reported. In reading that report it has undoubtedly been made clear to you that there was on the part of the House committee an expectation that the statements of the committee would be of a somewhat different character from those which were presented, and the determination of your committee to hold itself well within its original purpose rendered the situation somewhat delicate and difficult. Your committee firmly believes that the object sought by the association in directing the request for this hearing was fully accomplished, and the results were, broadly considered, good and satisfactory. It is recommended that the association take appropriate action to secure, if practicable, the presentation of the claims of the stations to the proper consideration and support of Congress at succeeding sessions of that body.

Subsequently satisfactory conferences were held with the Secretary, the Assistant Secretary, and other officials of the Department of Agriculture on the general subject of cooperation of the Department with the stations in research work. For satisfactory reasons your committee was led to decide that it would be improper to wish to continue these conferences to a definite conclusion at the time, but it is confidently believed that a mutual and cordial understanding of the views and desires of the stations and of the Department of Agriculture in cooperative work has been reached.

In the matter of the standing committees of the association referred to your committee, it is recommended that this convention order—

(1) That the standing committees of the association be as follows:

  (a) On bibliography.
  (b) On methods of teaching in the land-grant colleges.
  (c) On graduate study.
  (d) On extension work.
  (e) On experiment station organization and policy.

(2) That each committee shall consist of five members.

(3) That the committees shall be appointed and announced by the president of the association at the concluding session of each annual convention.

(4) That the members of the committees, when practicable and unless the president, for good cause, shall otherwise determine, shall be selected from those in attendance upon the convention at which the committees are appointed.

(5) That vacancies arising between conventions shall be filled by the committee in which the vacancy has occurred.

Your committee reports with profound sorrow and regret the death during the year of President Henry H. Goodell, of the Massachusetts Agricultural College, one of the founders and, until his death, a member of this association. The peculiar relations of President Goodell to the association have led your committee to assign an hour in the programme for this convention to a memorial of his life and services, and it has been fortunate in securing the consent of President W. E. Stone, of Indiana, a pupil and friend of President Goodell, to make the leading remarks. The association will doubtless be moved to take further action to signify respect for the memory of our late distinguishd member.

The finances of the association have been economically administered and are in satisfactory condition. All obligations have been promptly met, and the report of the treasurer will show a considerable balance in the treasury.

Respectfully submitted for the committee.

H. C. WHITE, *Chairman.*

The report was accepted. (For discussion of its recommendations see p. 42.)

REPORT OF TREASURER.

The secretary-treasurer, J. L. Hills, of Vermont, submitted the following financial statement:

Report of treasurer of the association, November 1, 1904, to November 14, 1905.

RECEIPTS.

Received of E. B. Voorhees, secretary-treasurer	$633. 92	
Received, refund of advance to joint agent Des Moines convention	17. 00	
Received, dues	1, 545. 00	
Total		$2, 195. 92

EXPENDITURES.

Executive committee	$1, 095. 45	
Secretary-treasurer, printing, postage, telegrams, etc	24. 40	
Railroad certificates, Des Moines	33. 20	
Stenographer, Des Moines	28. 25	
Wreath, funeral President Goodell	10. 00	
Expense account, President Voorhees, N. E. A. meeting	8. 75	
		1, 200. 05
Balance in bank November 14, 1905		995. 87

JOSEPH L. HILLS, *Secretary-Treasurer.*

The report was referred to an auditing committee consisting of W. D. Gibbs, of New Hampshire, and B. C. Buffum, of Wyoming, which subsequently reported as follows:

Your auditing committee beg to report that they have examined the books of the treasurer and that all accounts have been found correct.

The report was approved.

REPORT OF THE BIBLIOGRAPHER.

The bibliographer, A. C. True, of the Office of Experiment Stations, submitted the following report:

As has been the custom for a number of years, the more important bibliographies on agricultural subjects met with during the year have been noted from time to time in the Experiment Station Record, and have been compiled from that source to form the basis of this report.

An examination of the list here submitted will show the usual annual reports on the literature and general progress in animal diseases, bacteriology, chemistry, entomology, plant diseases, sericulture, zoology, and other general lines; a few special bibliographies on such subjects as the occurrence of aluminum in various products, North American Ustilagineæ, and the loco weed; and a considerable number of bibliographies or lists of references accompanying special articles or incorporated in text-books. Some of the subjects of the last class are as follows: Chemistry of proteids, nitrogen metabolism in plants, weather influences, plant breeding, formation of milk fat, soil bacteria, citrus fruits and their culture, textile fibers, timbers of commerce and their identification, and cheese ripening.

All the general bibliographies of agriculture noted in previous reports have been continued and a new one on the agricultural literature of Belgium has appeared.

Among the bibliographies appearing in bulletins and reports of the Department [illegible] re and the experiment stations are those on the following [illegible] nitrogen assimilation, seed selection according to specific gravity, a study of reciprocal crosses, invisible micro-organisms, vitality and germination of seeds, the powdery mildews, Japanese persimmons, irrigation in northern Italy, care of milk, nomenclature of the apple, the relation of bacteria to the flavor of Cheddar cheese, tuberculosis of animals, comparative virulence of human and bovine tubercle bacilli for animals, potato diseases, reclamation of Cape Cod sand dunes, and relation of food to the production of milk and butter fat by dairy cows.

The bibliographies referred to are more fully described in the following list, numbering 96 in all:

BAKER, C. F. A revision of American siphonaptera, or fleas, together with a complete list and bibliography of the group. Proceedings of the United States National Museum, 27 (1904), pp. 365–469.

BARBACCI, O. Summarischer Bericht über die wichtigsten italienischen Arbeiten auf dem Gebiete der allgemeinen Pathologie und pathologischen Anatomie, erschienen im Jahre 1903 (A brief report on the most important Italian literature in the field of general pathology and pathological anatomy for the year 1903). Centralblatt für Allgemeine Pathologie u. Pathologische Anatomie, 15 (1904), No. 16–17, pp. 671–713. This report contains a brief review of a large number of Italian books, pamphlets, and periodical articles on general pathology classified in 17 sections according to the parts of the body affected by different diseases.

BASS, E. Therapeutische Leistungen in der Tierheilkunde während der Jahre 1901 und 1902 (A brief report of veterinary literature concerning wounds for the year 1901–2). Deutsche Tierärztliche Wochenschrift, 12 (1904), No. 37, pp. 368–371. A critical discussion of the literature of the subject in connection with a bibliography of 51 titles.

BAUMGARTEN, P. VON, and TANGL, F. Jahresbericht über die Fortschritte in der Lehre von den pathogenen Mikroorganismen, 1902 (Annual report on progress in the study of pathogenic micro-organisms, 1902). Leipzig: S. Hirzel, 1904, 1. Abt., pp. 368. This report contains extended bibliographies relating to pathogenic bacteria, fungi, and protozoa, together with brief abstracts of the more important articles.

BERLESE, A. Illustrazione iconografica degli acari mirmecofili (Myrmecophilous acarids). Redia, 1 (1903), No. 2, pp. 299–474. A brief bibliography of the subject is appended to the article.

BISSON, E. Elenco di pubblicazioni attinenti alla Bachicoltura, che vennero fuori nel corso del 1903–1904 (List of publications relating to sericulture issued during the years 1903–1904). Annuario della R. Stazione Bacologica di Padova, 32 (1904), pp. 131–150. A list is given of books and periodical articles on the various lines related to sericulture as published in different languages during 1903 and 1904.

BLAKESLEE, A. F. Sexual reproduction in the Mucorineæ. Proceedings of the American Academy of Arts and Sciences, 40 (1904), No. 4, pp. 205–319. A bibliography of the subject concludes the paper.

BODLÄNDER, G., ET AL. Jahresbericht über die Fortschritte der Chemie und verwandter Teile anderer Wissenschaften, 1904 (Annual report of the progress in chemistry and related parts of other sciences for 1904). Brunswick: Friedrich Vieweg & Son, 1905, pp. 240.

BOLTON, H. C. A select bibliography of chemistry, 1492–1902, second supplement. Smithsonian Miscellaneous Collections, 44 (1904), No. 1440, pp. 462. This volume contains titles of books published between 1898 and 1902, inclusive, under the following heads: Bibliography; dictionaries; history; biography; chemistry, pure and applied; alchemical literature in the 19th century; periodicals; and academic dissertations.

BOUCHEZ, P. Classement méthodique des travaux, mémoires, articles, publiés sur la tuberculose (A systematic list of articles relating to tuberculosis). Revue de la Tuberculose, 2. ser., 1 (1904), No. 4, pp. 310–328. An elaborate list of books, memoirs, and periodical articles published during 1904 on the various phases of tuberculosis of animals and man.

BROWN, S. B. A bibliography of works upon the geology and natural resources of West Virginia, from 1764 to 1901, and a cartography of West Virginia from 1737 to 1901. West Virginia Geological Survey Bulletin 1, pp. 85.

BUCHANAN, R. E. A contribution to our knowledge of the development of *Prunus americana*. Proceedings of the Iowa Academy of Sciences, 1903, pp. 77–93. A list of 28 titles is appended.

CHESTER, F. D. Soil bacteria and nitrogen assimilation. Delaware Station Bulletin 66, pp. 24. A list of 20 references is appended.

Clark, V. A. Seed selection according to specific gravity. New York State Station Bulletin 256, pp. 367–425. A list of the more important works relating to the subject is appended.

Clinton, G. P. North American Ustilagineæ. Proceedings of the Boston Society of Natural History, 31, No. 9, pp. 329–529. A bibliography of over 200 of the more important articles relating to the Ustilagineæ is appended.

Cohnheim, O. Chemie der Eiweisskörper (The chemistry of proteids). Brunswick: Friedrich Vieweg & Son, 1904, 2. ed., pp. XII+315. The numerous footnote references given constitute an extended bibliography of the subject.

Connstein, W. Über fermentative Fettspaltung (Fermentive cleavage of fat). Ergebnisse der Physiologie, 3 (1904), pp. 194–232. A bibliography of 151 articles is given at the beginning of the article.

Cummings, M. B. Fertilization problems: A study of reciprocal crosses. Maine Station Bulletin 104, pp. 81–100. A bibliography of 32 papers on plant breeding is given.

Czapek, F. Der Stickstoff im Stoffwechsel der Pflanze (Nitrogen metabolism in plants). Ergebnisse der Physiologie, 3 (1904), pp. 309–331. A bibliography of 81 titles is given.

Darbishire, A. D. On the bearing of Mendelian principles of heredity on current theories of the origin of species. Memoirs and Proceedings of the Manchester Literary and Philosophical Society, 48 (1904), pt. 3, No. 24, pp. 19. A bibliography of the subject is appended to the article.

Deegener, P. Die Entwicklung des Darmcanals der Insecten während der Metamorphose (The development of the intestines in insects during metamorphosis). Zoologische Jahrbücher, Abtheilung für Anatomie und Ontogenie der Thiere, 20 (1904), No. 4, pp. 499–676. A brief list of references to the literature of the subject is appended.

Dexter, E. G. Weather Influences. New York and London: The Macmillan Company, 1904, pp. XXXI+286. A list of 68 references to the literature of this subject is given on pages 279–281.

Dietrich, F., **et al.** Bibliographie der deutschen Zeitschriften-literatur (Bibliography of German periodical literature). Leipzig: Felix Dietrich, 1905, Vols. XIV, pp. 377; XV, pp. 350. This is a subject and author index of original articles, mainly of a scientific character, published in 1904 in about 4,000 German periodicals, pamphlets, and newspapers.

Dorset, M. Invisible micro-organisms. U. S. Department of Agriculture, Bureau of Animal Industry Report 1903, pp. 139–156; Circular 57, pp. 139–156. A list of 26 references to the literature of the subject is appended to the article.

Dunstan, W. R. Report on cotton cultivation in the British Empire and in Egypt. London: Darling & Son, Ltd., 1904, pp. 40. A list of references to the literature of cotton and its cultivation is appended.

Duvel, J. W. T. The vitality and germination of seeds. U. S. Department of Agriculture, Bureau of Plant Industry Bulletin 58, pp. 96. A list of 52 references to the literature of the subject is given.

Dyé, L. Les parasites des Culicides (The parasites of Culicidæ). Archives de Parasitologie, 9 (1904), No. 1, pp. 5–77. A brief bibliography is appended.

Felt, E. P. Mosquitoes or Culicidæ of New York State. New York State Museum Bulletin 79, pp. 241–400. A bibliography containing the more important references to American species of mosquitoes is appended to the bulletin.

———, and **Joutel**, L. H. Monograph of the genus Saperda. New York State Museum Bulletin 74, pp. 86. References are given to the literature of the species of this genus.

Fort, H. Der Obstbau im Tätigkeitsgebiete der böhm. Sektion des Landeskulturrates für das Königreich Böhmen (Fruit culture in Bohemia). Prague: Anton Purkrábek, 1904, pp. 39. A bibliography of 58 papers on Bohemian fruit culture is given.

Fruwirth, C. Die Züchtung der landwirtschaftlichen Kulturpflanzen (The breeding of agricultural plants). Berlin: Paul Parey, 1905, vol. 1, 2. rev. ed., pp. XVIII+345. A bibliography of 59 works and articles and 31 periodicals cited in the book is given.

———. Referate über neuere Arbeiten auf dem Gebiete der Pflanzenzüchtung (References to recent work on plant breeding). Journal für Landwirtschaft, 52 (1904), No. 3, pp. 269–290. References are given to 31 recent articles on plant breeding in connection with different crops.

Glinka, K. Latérites et "terræ rossæ" des régions tropiques et sous-tropiques et terres analogiques sous les latitudes tempérées (Laterites and red soils of tropical and subtropical latitudes and allied soils of temperate latitudes). Pochvovyedenie [Pédologie], 5 (1903), No. 3, pp. 235–264. A list of 50 titles is given.

Gogitidse, S. Vom Übergang des Nahrungsfettes in die Milch (The transformation of food fat into milk fat). Zeitschrift für Biologie, 46 (1905), No. 3, pp. 403–420. A bibliography is appended.

Goldberg, A. Ueber die Fortschritte auf dem Gebiete der Chemie des Wassers, sowie der natürlichen und künstlichen Mineralwässer (A review of progress in the chemistry of waters, especially natural and artificial mineral waters). Chemiker Zeitung, 28 (1904), No. 77, pp. 908–912). A review of investigations on this subject containing 184 references to articles which appeared during 1902 and 1903.

Gossmann. Die chronische Periarthritis Tarsi des Pferdes (Chronic periarthritis tarsi of horses). Monatshefte für praktische Thierheilkunde, 15 (1904), No. 9–10, pp. 385–417. A critical review of the literature of the subject in connection with a brief bibliography.

Grips, W., Glage, F., and Nieberle, C. Die Schweineseuche (Swine plague). Fortschritte der Veterinär-Hygiene, 2 (1904), Nos. 1, pp. 5–18; 2, pp. 49–73; 3, pp. 82–107; 4, pp. 113–135. A brief list of references to the literature of the subject is appended.

Halsted, B. D., and Kelsey, J. A. The powdery mildews. New Jersey Stations Report 1903, pp. 517–536. A list of 34 references to the literature of the subject is appended to the article.

Henneguy, L. F. Les insectes (Insects). Paris: Masson & Co., 1904, pp. 804. The literature of various subjects in entomology is briefly reviewed and a bibliography of 62 pages is included in the volume.

Hilger, A., Dietrich, T., et al. Jahresbericht über die Fortschritte auf dem Gesamtgebiete der Agrikultur-Chemie, 1903 (Annual report of the progress in agricultural chemistry, 1903). Berlin: Paul Parey, 1904, pp. XXXVI+661.

Hine, J. S. Tabanidæ of the western United States and Canada. Ohio State University Bulletin, 8. ser., No. 35; reprinted from Ohio Naturalist, 5 (1904), pp. 217–249. Bibliographical references are given to the species treated.

Hohl, J. Sur quelques bactéries du sol et leur importance pour l'agriculture (On some soil bacteria, and their importance in agriculture). Annuaire agricole de la Suisse, 5 (1904), No. 6, pp. 201–228. Numerous references to the literature of the subject are given in footnotes.

Hume, H. H. Citrus fruits and their culture. Jacksonville, Fla.: The H. and W. B. Drew Co., 1904, pp. XXII + 597. A list of 44 references to the literature of the subject is given on pages 557–562.

———, and Reimer, F. C. Japanese persimmons. Florida Station Bulletin 71, pp. 68–110. A list is given of 46 references to American literature relating to the Japanese persimmon.

Jaccard, P. Les Mycorhyzes et leur rôle dans la nutrition des essences forestières (Mycorrhiza and its rôle in the nutrition of forest trees). Journal Forestier Suisse, 1904, No. 2–3, pp. 30. A bibliography is given of the principal works relating to this subject.

Janasz, S. Beschreibung einiger Zuckerrübenrassen (Description of several types of sugar beets). Mitteilungen der Landwirtschaftlichen Institute der Königlichen Universität Breslau, 2 (1904), No. 5, pp. 913–970. A list of 42 references to the literature of the subject is appended to the article.

Kellerman, W. A. Journal of Mycology, index. Journal of Micology, 10 (1904), No. 74, pp. 289–392. An index to the first 10 volumes of this journal.

Klebahn, H. Die wirtwechselnden Rostpilze (Heterœcious rust fungi). Berlin: Borntraeger Bros., 1904, pp. XXXVII + 447. This includes extended bibliographies.

Krarup, A. V. Nogle Undersøgelser over Nedarvning og Variabilitet hos Havre, med særligt Hensyn til Muligheden af at isolere fedtrige Typer, der egner sig til Havregrynsfabrikation (Some investigations of transmission and variability in oats, with special reference to the possibility of isolating types high in fat adapted to the manufacture of shelled oats). Copenhagen: Aug. Bang, 1903, pp. 70. A bibliography of 17 references is appended.

Krüger, F. Untersuchungen über den Gürtelschorf der Zuckerrüben (Investigations on the zonal scab of beets). Arbeiten aus der Biologischen Abteilung für Land- und Forstwirtschaft am Kaiserlichen Gesundheitsamte, 4 (1904), No. 3, pp. 254–318. A bibliography of 92 titles is appended to the article.

Langstein, L. Die Kohlehydratbildung aus Eiweiss (Formation of carbohydrates from protein). Ergebnisse der Physiologie, 3 (1904), pp. 453–496. A bibliography of 84 articles is given.

Langworthy, C. F., and Austen, P. T. The occurrence of aluminium in vegetable products, animal products, and natural waters. New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1904, pp. V + 168. A bibliography of 671 references to reports on the occurrence of aluminium in the various products named.

Leidy, J. Researches in helminthology and parasitology. Smithsonian Miscellaneous Collections, 46, No. 1477, pp. 1–281. Bibliography and abstracts of the publications of Joseph Leidy are given.

Lucas, R. Bericht über die wissenschaftlichen Leistungen im Gebiete der Entomologie während des Jahres 1900 (Report on scientific work in the field of entomology during 1900). Archiv für Naturgeschichte, 67 (1904), II, No. 2, 2. half, pp. 289–944. An extensive bibliography of literature relating to Hymenoptera and Lepidoptera published during the year 1900.

Luginger, J. Streptothricheen als Ursache von Endocarditis beim Rind (Streptothrices as the cause of endocarditis in cattle). Monatshefte für Praktische Thierheilkunde, 15 (1904), No. 7–8, pp. 289–336. The literature relating to the bacteriology of endocarditis in animals and man is critically reviewed in connection with a brief bibliography.

McAlpine, D. Native or Blackfellows's bread. The Journal of the Department of Agriculture of Victoria, 2 (1904), No. 10, pp. 1012–1020. A list of 20 references to the literature of the subject is appended.

Matthews, J. M. The textile fibers: Their physical, microscopical, and chemical properties. New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1904, pp. VII + 288. A bibliography of 75 references to the literature of the subject is given in an appendix.

Mayer, P. Zoologischer Jahresbericht für 1903 (Zoological Yearbook for 1903). Berlin: R. Friedländer & Son, 1904, pp. VIII+596. Detailed bibliographic lists relating to the various groups of animals. The more important publications under each group are briefly abstracted.

Mead, E. Irrigation in Northern Italy, I. U. S. Department of Agriculture, Office of Experiment Stations Bulletin 144, pp. 100. A bibliography containing references to 100 of the more important works relating to Italian irrigation is given on pages 17–23

Meyer, R., et al. Jahrbuch der Chemie (Yearbook of chemistry). Brunswick: Friedrich Viewig & Son, 1904, vol. 13, pp. VII+600. A biographical and bibliographical review of the more important advances in pure and applied chemistry during the year 1903.

Michniewicz, A. R. Die Lösungsweise der Reservestoffe in den Zellwänden der Samen bei ihrer Keimung (The solution of reserve material in the cell walls of seed during germination). Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften [Vienna], Mathematisch-Naturwissenschaftliche Klasse, 112 (1903), No. 4–7, pp. 483–510. A brief bibliography is appended.

Morse, M. Batrachians and reptiles of Ohio. Ohio State University Bulletin, 8. ser., No. 18, pp. 91–144. Bibliographic references are given to the species known to occur within the State.

Nedokvochavev, N. Über die Speicherung und Reduction der Nitrate in den Pflanzen (Conditions of accumulation and reduction of nitrates in plants). Izvyestiya Moskovskagho Sel'skokhozyaistvennagho Instituta [Annales de l'Institut Agronomique de Moscou], 10 (1904), No. 1, pp. 257–347. A bibliography including 127 titles is appended.

Neuberg, C. Die Physiologie der Pentosen und der Glukuronsäure (The physiology of pentoses and gluconic acid). Ergebnisse der Physiologie, 3 (1904), pp. 373–452. A bibliography of 292 titles is given.

Nicholls, A. G. An experimental study on the effect of the blood sera of normal and immunized goats in modifying the progress of tuberculous infection. Proceedings and Transactions of the Royal Society of Canada, 2. ser., 9 (1903), IV, pp. 3–32. A list of 120 references to the literature of serum treatment of tuberculosis is appended to the article.

OPITZ, K. Untersuchungen über Bewurzelung und Bestockung einiger Getreidesorten (Investigations on the rooting and tillering of grains). Mitteilungen der Landwirtschaftlichen Institute der Königlichen Universität Breslau, 2 (1904), No. 4, pp. 749–816. Numerous footnote references are given and a bibliography of 78 titles is appended to the article.

OTTAVI, E., MARESCALCHI, A., ET AL. Bibliographia agronomica universalis. Casale: Ottavi Bros., 1904, No. 6, pp. 89–192. This is a continuation of the general agricultural bibliography noted in previous reports. The number of articles noted has reached 3,786.

PEARSON, R. A. Syllabus of illustrated lecture on the care of milk. U. S. Department of Agriculture, Office of Experiment Stations, Farmers' Institute Lecture 1, pp. 12. References to recent literature of this subject are appended.

PHILLIPS, W. F. R., and KIMBALL, H. H. Recent papers bearing on meteorology. U. S. Department of Agriculture, Weather Bureau, Monthly Weather Review, 32 (1904), pp. 9, 65, 126, 174, 227, 275, 308, 369, 414, 461, 502, 552.

POPPER, R. Über die Formelemente des Colostrums, ihre Entstehung und Bedeutung (On the formed elements of colostrum, their origin and significance). Archiv für die Gesammte Physiologie des Menschen und der Thiere, 105 (1904), No. 11–12, pp. 573–613. A bibliography is appended to the article.

RAGAN, W. H. Nomenclature of the apple; a catalogue of the known varieties referred to in American publications from 1804 to 1904. U. S. Department of Agriculture, Bureau of Plant Industry Bulletin 56, pp. 383. A bibliography of the literature consulted, comprising 233 papers, is appended.

RICHARDS, ELLEN H., and WOODMAN, A. G. Air, water, and food from a sanitary standpoint. New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1904, 2. ed., rev. and enl., pp. 262. A list is given of some of the more important works bearing on the subjects treated.

ROGERS, L. A. The relation of bacteria to the flavors of Cheddar cheese. U. S. Department of Agriculture, Bureau of Animal Industry Bulletin 62, pp. 38. The appended bibliography furnishes references to 21 articles used in this review.

SALMON, D. E. Some observations on the tuberculosis of animals. U. S. Department of Agriculture, Bureau of Animal Industry Report 1903, pp. 69–88. A list of 30 references to the literature of this subject is appended to the article.

SAYRE, L. E. Bibliography of the loco weed. Transactions of the Kansas Academy of Science, 19 (1903–4), pp. 194–197. A bibliography of articles relating to the loco weed.

SCHENKE, V. Phosphorsaurer Kalk als Futterbeigabe (Calcium phosphate as a part of a ration). Die Landwirtschaftlichen Versuchs-Stationen, 58 (1903), No. 3–4, pp. 291–312. The article includes a list of 56 references to the literature of the subject.

SCHWEINITZ, E. A. DE, DORSET, M., and SCHROEDER, E. C. Experiments concerning tuberculosis. II, The comparative virulence of human and bovine tubercle bacilli for some large animals. U. S. Department of Agriculture, Bureau of Animal Industry Bulletin 52, pt. 2, pp. 100. A brief bibliography of the subject is appended.

SELIGMANN, E. Ueber den Einfluss einiger Aldehyde, besonders des Formalins, auf die Oxydationsfermente der Milch und des Gummi arabicums (On the influence of certain aldehydes, especially formaldehyde, on the oxidizing ferments in milk and gum arabic). Zeitschrift für Hygiene und Infectionskrankheiten, 50 (1905), No. 1, pp. 97–122. A bibliography is appended.

SMITH, T., and REAGH, A. L. The agglutination affinities of related bacteria parasitic in different hosts. Studies from the Rockefeller Institute for Medical Research, 1 (1904), Art. 12; reprinted from Journal of Medical Research, 9 (1903), No. 3, pp. 270–300. A bibliography of about 20 publications relating to the subject completes the paper.

STAZZI, P. Il corpuscolo di Negri e la diagnosi rapida della rabbia (Negri's corpuscle and the rapid diagnosis of rabies). La Clinica Veterinaria [Milan], 27 (1904), Nos. 42, pp. 249–254; 44, pp. 261–265; 46, pp. 273–277. A brief list of references to the literature of the subject is appended.

STEWART, F. C., and EUSTACE, H. J. Syllabus of illustrated lecture on potato diseases and their treatment. U. S. Department of Agriculture, Office of Experiment Stations, Farmers' Institute Lecture 2, pp. 30. A list of 47 references is appended.

Stiles, C. W., and Hassall, A. Index-catalogue of medical and veterinary zoology. U. S. Department of Agriculture, Bureau of Animal Industry Bulletin 39, pts. 7–13, pp. 511–950. These parts of this bulletin include authors whose names begin with the letters G to K, inclusive.

Stoklasa, J., et al. Ueber die Isolierung gärungserregender Enzyme aus Kuhmilch (On the isolation of fermentative enzyms from cows' milk). Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich, 7 (1904), No. 11, pp. 755–774. A list of about 30 references is appended.

Stone, H. The timbers of commerce and their identification. London: William Rider & Son, Ltd., pp. XXXVIII+311. A bibliography of 132 references to the literature of the subject is given.

Teichert. Bakteriologisch-chemische Studien über die Butter in der Provinz Posen mit besonderer Berücksichtigung der Tuberkelbacillen (Bacteriological and chemical studies of the butter in the Province of Posen, with especial reference to the tubercle bacillus). Inaugural Dissertation, University of Jena, 1904. A bibliography of the subject is included.

Vandevelde, A. J. J. Répertoire des travaux publiés sur la composition, l'analyse et les falsifications des denrées alimentaires pendant l'année 1903 (Review of the literature of composition, analysis, and adulteration of foods for the year 1903). Separate from Bulletin du Service de Surveillance de la Fabrication et du Commerce des Denrées Alimentaires, 1904, pp. 101. This contains 725 references and is the fourth volume on this subject.

Voss, W. Über die durch Pfropfen herbeigeführte Symbiose einiger Vitisarten, ein Versuch zur Lösung der Frage nach dem Dasein der Pfrophhybriden (The symbiosis of grape species in grafting; an experiment for the solution of the question of the existence of graft hybrids). Landwirtschaftliche Jahrbücher, 33 (1904), No. 6, pp. 961–996. A bibliography of 56 papers on the subject is included.

Waele, H. de, Sugg, E., and Vandevelde, A. J. J. Sur l'obtention de lait cru stérile (Obtaining raw sterile milk). Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten, 2. Abt., 13 (1904), No. 1–3, pp. 30–35. A list of 21 titles is appended to the article.

Weber, S. Über die Beeinflussung des Stoffwechsels durch einige pharmakologisch wichtige Stoffe (The influence of active pharmacological principles on metabolism). Ergebnisse der Physiologie, 3 (1904), pp. 233–289. A bibliography of 550 articles is given.

Westgate, J. M. Reclamation of Cape Cod sand dunes. U. S. Department of Agriculture, Bureau of Plant Industry Bulletin 65, pp. 38. The bulletin concludes with a brief bibliography of the literature relating to the subject.

Winkler, W. Der gegenwärtige Stand der Käsereifungsfrage (The present status of the question of cheese ripening). Centralblatt für Bakteriologie, Parasitenkunde u. Infektionskrankheiten, 2. Abt., [illegible] (1904), No. 4–5, pp. 97–105; 9–10, pp. 273–289. A review of the literature of this subject with an appended bibliography of 51 articles.

Woll, F. W. On the relation of food [illegible] milk and butter fat by dairy cows. Wisconsin Station [illegible] A list of 151 references is given in an appendix to [illegible]

Bibliographie agricole Belge. (Agri[illegible] Belgium), Brussels: J. Vandervorst, pp. 170. "This [illegible] bibliography of Belgian agricultu[illegible] literature, and [illegible] and articles of more [illegible] pages which [illegible] Lists of the publications of [illegible] Belgian Departm[illegible] principal agricultural j[illegible] Belgium ar[illegible]

Bibliographie der De[illegible] [illegible] (Bibliography of German [illegible] literature), [illegible] 1904, vol. 5, Nos. 25–38, pp. [illegible]

International Catalog[illegible] [illegible] D—Chemistry, 1904, [illegible] VIII+296; L—Genera[illegible] 1904, December, pp. V[illegible] VIII+620; pt. 2, pp. 621–[illegible] indexes to the literature of [illegible]

A. C. True. In this connectio[illegible] Office of Experiment Stations w[illegible] written by college and station of[illegible] tion we have now a quite complete collection, pretty well up to date, but as you are publishing books, be sure to remember the Office of Experiment Stations and its collection.

The report of the bibliographer was accepted.

UNIFORM FERTILIZER AND FEEDING STUFF LEGISLATION.

H. J. Wheeler, of Rhode Island, chairman of this committee, submitted the following report:

Your committee begs to report that during the past year requests have been received from several States where feeding-stuff legislation was either pending or anticipated for suggestions concerning such acts. In all such cases the attention of inquirers has been directed to the points of uniformity already adopted and recommended by this association.

Since the last report concerning the efforts to secure uniformity in fertilizer laws, the law of the State of New York has been modified, conforming in its chief features to the existing recommendations of this association and of the Association of Official Agricultural Chemists. The State of Tennessee is also reported to have passed a new act based upon these recommendations but with some modifications. It is reported from Florida that the law of that State, which was amended in 1901, based upon the recommendations, has been found to be a vast improvement upon the former act.

A new fertilizer law was passed by the State of Kansas in 1903 which differed in many essential details from the association's recommendations and which has been officially recognized in that State as capable of much improvement.

It will be recalled that in a former report it was shown that the recommendations have already been largely adopted in recent modification of the laws of a considerable number of the States. Nevada, Wyoming, New Mexico, Colorado, Minnesota, Arizona, Oregon, Nebraska, and Utah are reported to have no fertilizer laws. Inquiries have nevertheless been received from Utah and Colorado concerning the recommendations of this association, indicating that the matter is already coming under consideration in that State.

Respectfully submitted.

H. J. WHEELER,
CHAS. D. WOODS,
E. H. JENKINS,
M. A. SCOVELL,
H. P. ARMSBY,
Committee.

The report was accepted.

On motion of J. L. Hills, of Vermont, delegates and visitors in attendance at the convention of the Association of State Universities were admitted to the privileges of the floor.

REPORT OF COMMITTEE ON METHODS OF SEED TESTING.

The following report was read by the secretary:

The standing committee on methods of seed testing begs to report that, since the adoption by your association of the revised rules for seed testing, nothing on the subject has called for the attention of this committee, or for report to the association.

Respectfully submitted for the committee.

E. H. JENKINS, *Chairman.*

The report was accepted.

FORESTRY IN LAND-GRANT INSTITUTIONS.

S. B. Green, of Minnesota, offered the following resolution:

Whereas the forests of this country are fast disappearing, and little or no attention is being paid to their renewal; and

Whereas the development of this country is seriously threatened by a shortage timber supply: Therefore be it

Resolved by the Association of American Agricultural Colleges and Experi- nt Stations in convention assembled, First. That the national-forestry policy of this country should include provision for education and experimentation in forestry by the agricultural colleges and experiment stations of the different States and Territories.

Second. That the Congress of the United States be asked to appropriate adequate sums for the promotion of forest education and experimentation in the agricultural colleges and experiment stations of the United States.

Third. That the executive committee of this association be, and is hereby, directed to prepare a suitable bill with this purpose in view, and strongly urge its passage by Congress at its forthcoming session.

The resolution was referred to the executive committee. (For further action see p. 53.)

INSTRUCTIONS TO THE EXECUTIVE COMMITTEE REGARDING CONGRESSIONAL LEGISLATION.

G. W. Atherton, of Pennsylvania, offered the following resolution:

Resolved, That the executive committee be, and hereby is, instructed to use its best efforts to promote the passage of the Adams bill, and also to give such assistance to the Mondell bill as in its judgment may be advisable and as circumstances may justify.

G. W. ATHERTON. The resolution, I hope, is plain enough to explain its own purpose and purport, which is to concentrate the influence of the association on the passage of the Adams bill. But I would like to say, as explaining and interpreting the second clause, that there is a feeling on the part of those who are interested in the Mondell bill that they will not get support enough from this association. The Association of State Mining Schools is naturally pushing the Mondell bill, and there is no reason to suppose that this association, from its past history and its past committal to this bill, would throw any obstacles in the way of that bill, and that it had definitely decided to push for one thing now. The purpose of the resolution is to concentrate the attention of the committee on the Adams bill and at the same time to leave it free to act, in view of the contingencies that arise in the progress of legislation.

The resolution was referred to the executive committee. (For further action see p. 42.)

E. A. BRYAN, of Washington. I think there is perhaps some misunderstanding about a reference to the executive committee. As I understand, the one purpose of such reference is to fix a suitable time for the consideration of the matter, and not in order that the executive committee may make a report on the advisability or inadvisability of this or any other resolution.

The PRESIDENT. The provision is that resolutions shall be referred to the executive committee without debate, to be assigned a place upon the programme.

E. A. BRYAN. And not for the purpose of eliciting their views.

K. L. Butterfield, of Rhode Island, offered the following resolution:

RESOLUTION REGARDING A DEPARTMENT OF AGRICULTURAL EDUCATION IN THE NATIONAL EDUCATIONAL ASSOCIATION.

Whereas this association believes that the questions involved in the general and the technical education of the rural people are of sufficient importance to warrant special recognition in the great gatherings of American educators: Therefore, be it

Resolved, That our executive committee be hereby instructed to take such steps as they may consider necessary in an endeavor to secure the consent of the National Educational Association to add to its list of special departments a department or departments on rural and agricultural education.

The resolution was referred to the executive committee. (For action on it, see p. 47.)

Thereupon, at 12 o'clock noon, the convention adjourned until 8 p. m.

EVENING SESSION, TUESDAY, NOVEMBER 14, 1905.

The convention was called to order at 8.30 o'clock p. m., J. C. Hardy, of Mississippi, first vice-president, in the chair.

STATISTICAL WORK OF THE U. S. DEPARTMENT OF AGRICULTURE.

H. J. Waters, of Missouri, offered a resolution relating to this work, which was referred to the executive committee. (For action on it see p. 49.)

PETITION OF ASSOCIATION OF MINING SCHOOLS REGARDING INDORSEMENT OF MONDELL BILL.

A petition from the National Association of State Mining Schools, requesting a reindorsement by the association of the Mondell bill, was presented by H. C. White, of Georgia, and was referred to the executive committee. (See p. 42.)

President E. B. Voorhees, of New Jersey, was introduced and delivered the annual presidential address, as follows:

ANNUAL ADDRESS OF THE PRESIDENT OF THE ASSOCIATION.

A review of the proceedings of our annual conventions and their relations to the development of the work of the colleges and stations in the last eighteen years would doubtless be profitable and interesting at this time, as showing the influence of this association in unifying sentiment and directing and concentrating effort along the lines of progress. I shall, however, refer but briefly to our early history, but will discuss in a general way some of our present-day problems, particularly in their relation to the education of the farmer and his family. In the early history of this association there were, as was to be expected, two distinct views held by the officers of the institutions, as to the character of the larger work that should be done by the colleges provided for by the Hatch Act of 1887, and the Morrill Act of 1890.

On the one hand, those who had received their training in our older institutions, were conservative and adhered strongly to the old landmarks in reference to educational methods, and with glowing periods and persuasive logic demanded in the founding and developing of these new institutions that the old curriculum of studies, which had for centuries been found to fulfill the requirements in the development of the intellectual faculties of man, should be, in large part, retained. They urged that "the student must be taught to think; that the powers of reason and memory could be strengthened in no way quite so well as by a rather close adherence to the classical studies." On the other hand, those who had been trained mainly in the field of action urged quite as strenuously that "the time for a new departure had come; that students should be taught to do, as well as to think, and that the powers of reason, memory, and observation could be developed quite as well by a study of science and its manifestations and applications as by the study of subjects formerly regarded as alone capable of leading to that end, and demanded the entire elimination of these from the agricultural and other courses of a rather scientific character."

It is evident that rapid progress along the right lines could not be made as long as these opposing and, in a sense, antagonistic views were held. A study of the proceedings of the conventions shows, however, that wise concessions were made from time to time on both sides. The conservative parties were unable—nor did they persist in their attempt—to resist the logic of the situation. The demand for workers in technical fields was imperative, and would permit only in exceptional cases that thorough education which the old curriculum afforded. The others learned, on their part, that technical studies alone, while training men more quickly for practical activity, could not in themselves be regarded as sufficient from the broader educational standpoint. The best men in the technical pursuits, the leaders, whether in chemistry, engineering, electricity, the scientists in the various branches of experiment station work, had received, as a rule, a broader training than was made possible by the strictly technical studies, and thus a judicious adjustment was effected. The excellent standing of these State institutions to-day; their, in a sense, conservative, though progressive, character; their adaptation to the newer conditions and requirements are a monument to these men, who, by their clearness of vision, breadth of view, and unselfishness of purpose, have interpreted the trend of the times and its educational needs. The representatives of these institutions, who were wise enough to retain the best of the old, while including at the same time the best of the new, have secured for them that permanency and that degree of present usefulness which command the respect and admiration of those interested in industrial education in this and all countries. A result like this could not have been accomplished without the influence of this representative organization.

On our experiment station side, too, there have been men who have insisted that any permanent good to be accomplished must come from investigations of a high order; that men should absent themselves from the world and, in their laboratories, seek to know the mysteries of nature, and from their discoveries to formulate principles which, in their application, would be of inestimable service to the world. Others have urged quite as strongly that the experiment station should first demonstrate to the farmers the utility of the stations' work; prove, by tests in the field, the barn, and the laboratory, that the principles already known are of the greatest service when applied in practice. The farmers were crying for bread, in the shape of practical information; why give them a stone, in the shape of scientific disquisitions, upon agricultural matters to be sure, but beyond their comprehension? "To know how to do," rather than to "know how to enjoy the fruits of higher scientific research," is what the farmer needs. As in the case of the colleges, the stations, too, have made great progress in their development along right lines. There has been, on the whole, a fair adjustment and combination of doing and thinking, and many stations are now equipped for and are pursuing highly scientific investigations, without at the same time losing touch with the farmer, for whom, primarily, the stations were established. Great things have been accomplished, and, as an evidence of this, the following figures may be quoted:

In 1892, when the first complete statistical report of these institutions was made, there were in the various agricultural colleges 11,358 students, of whom 3,460 were taking agricultural courses. The total revenues in that year were $3,444,426, of which $1,716,108 was received from Federal grants; $1,111,588 was derived from the various States, and the balance from fees and miscellaneous sources. In 1904 there was a total of 56,226 students in the various land-grant colleges, of which 12,033 were taking courses in agriculture or allied subjects. The Federal aid granted in that year was $2,015,136, and State aid, including appropriations for buildings and special purposes, $5,617,902; in other words, $2.17 was received from the various States for every dollar appropriated by the United States Government.

In 1892 the several States received under the Hatch Act $690,000; in that year 13 States appropriated a total of $152,000. In 1904 the increase from the Federal Treasury was but $15,000, yet the number of States contributing to the support of their experiment stations had increased to 34, and the amount appropriated from $152,000 to $522,391, or a sum from State treasuries nearly equal to that from Federal grants.

While the association is, therefore, to be congratulated upon the great progress that has been made by both colleges and stations in the past twelve years, as shown by these figures, it should not be assumed for one moment that because the institutions are now well established upon foundations broad and deep; that because the superstructures in course of erection are showing such evidences of beauty of form, harmony in adjustment, and utility of purpose, the completion of the work may safely be left to itself. There has been no time in the history of these institutions that called for greater wisdom of direction than the present moment; too great an increase in material wealth may easily be a menace, rather than an aid to right development and true progress, for the statement that "a certain amount of money is necessary, both for the individual and for the Government," is applicable to educational institutions. It must be remembered that the value of these institutions, both stations and colleges, is not determined so much by fine buildings, elaborate equipment, and exceptional facilities for work as by the men who direct the work of the various departments, and it is quite conceivable that the supply of men properly trained may not keep pace with the growth of equipment and endowment. I am persuaded, also, that the increase in the number of students in a college is not always a measure of its success and usefulness, or that the number of bulletins issued from an experiment station is a measure of the value of the work done there. Many boys may have been drawn from the farms to the shorter courses in the colleges by the picturesque circulars calling attention to the great advantages to be derived from " a little learning." These, as a rule, do not appeal to the best men, but rather to those who are attracted by the " get-rich-quick " plan, who from a smattering of many things can take positions which will enable them to get a living more easily than on the farm. It is a fact, too, that many of the most valuable bulletins of the stations are not read, and if read are not appreciated at their true worth.

The growth in material things, as evidenced by large State appropriations, may, in other words, indicate not so much the awakening of the farmer himself, or his realization of his educational needs, and the demand that they be satisfied, as the progress made in the various States in the entirely legitimate and proper education of the nonfarmer members of the legislature, for it is a notorious fact, that of the States where farmers constitute a large proportion of the members of the legislature, many have been the most backward in voting appropriations for the college of agriculture or for the experiment station. The increase in the number of genuine students in the colleges—and by "genuine" I mean those who attend for the purpose of acquiring knowledge and the direct helpfulness of the experiment stations to the farmers—have been due to the influence of the work of, or of personal contact with, one or more men in the institutions, whose breadth of view, sincerity of purpose, and strength of character have inspired both young and old with the desire to sit at their feet, rather than to buildings, equipment, or exceptional facilities. I have no doubt that the members of this association have felt the possible dangers pointed out here as constituting a real menace to future progress, and I am sure I shall not be misunderstood when I urge that the pressing needs of to-day are for men rather than equipment, and that, paradoxical as it may seem, the duty of this association, as representing the institutions in the various States, is to see to it that both a broader and a more elementary education shall be provided. The character of the work of the experiment stations is not high enough, because of the lack of a sufficient number of broadly trained men in the various departments of chemistry, botany, entomology, etc., who are capable of planning highly scientific investigations. Analysts who are unable to plan a comprehensive experiment, or to interpret their experimental results, are not chemists; collectors, unable to originate or pursue a definite and helpful line of investigation, are not botanists or entomologists. Experiment stations need a larger number of true scientists, if their work is to be of a more permanent character. It may be said that scientific investigators of a higher order, like poets, " are born, not made," which is undoubtedly true, and hence the greater necessity of a larger number of broadly trained students from among whom men may be drawn that shall be capable teachers and investigators. The teaching functions of the experiment stations must be exercised as long as the great mass of farmers are unfamiliar with the applications of the principles of science, and the beneficial results of investigations must of necessity remain largely indirect; none the less the influence of the stations has already proved of inestimable value to the country. What it will be when its work touches directly all of the various interests of the people, as it surely must, can only be faintly conjectured. The opinion has been expressed that the establishment of the land-grant colleges, together with those important branches, the experiment stations, was one of the most beneficent acts of legislation ever enacted by this Government. This opinion is concurred in by all who have given the subject careful thought, not only because it has to do primarily with the education and consequent uplifting of the industrial classes, but also because in its best sense it has to do with the development, conservation, and use of the nation's wealth, viz, the elements which constitute its soil, increasing the intelligence and broadening the views both of the man who directs nature's energies in the creation of new products, and of him who transforms them into merchantable forms or transfers them to the consumers. I do not agree with those who regard the land-grant college as primarily the place where the student may secure technical education that shall best fit him for his duties as a farmer. The land-grant college is the farmer's college, but it should furnish opportunities for the farmer's boy to secure a training along the lines which shall best suit his inclinations, though I believe that those who shall study engineering, or law, or medicine, or other technical or professional pursuits, or shall fit themselves there to be more helpful to their fellow-men in any direction, should acquire there such a knowledge of the principles of agricultural science as to enable them to at least understand the relation of this, the primary industry, to the other great industries of the world, and the relation of the latter to the products of the farm, as well as to the progress of the country and the benefit of all the people. This organization, therefore, represents in an educational sense the greatest of all human interests, because it includes them all. Each State here represented is an empire in itself, when considered from the standpoint of potential development. The possibilities in this direction are so great, particularly as concerns the need of improvement in economic and social conditions, that those engaged in the work can not help but chafe under the restraint caused by the inertness of those forces, governmental and otherwise, which should be exercised in their behalf.

Our first question, then, is, What is the responsibility of this organization? for it seems to me that the responsibility for the development and progress of agriculture must rest most of all with the institutions that we represent. I am well aware that it is the essential duty of an agricultural college, in common with others, to give proper instruction to its students, yet because the agricultural college in any State is, or should be, at the fountain head of the agricultural education, it is not merely directly responsible for the education of the students who come to its halls, but indirectly responsible for the education of the masses engaged in agriculture. It is not sufficient that this work should be touched here and there by the agricultural college, for the mass of farmers shall be so instructed as to enable them to take advantage in a practical way of the knowledge in our possession. The last United States census showed that there were in the United States 5,739,657 farms and about 11,000,000 farmers, who, with their families, constitute about three-fifths of our population. The Report of the Office of Experiment Stations, in its statistics of land-grant colleges for 1904, shows that there have been graduated from these institutions, since their organization, 57,909 students, or practically one student for each hundred farms. Had all of these students been graduated from the agricultural courses, and had they all engaged in farming, only 1 per cent of the farms of the country would have been thus directly influenced by the agricultural colleges. The facts are, however, that a very small proportion of this total number of students were graduated from the agricultural courses, and of these a very large proportion were not directly engaged in farming, though interested in allied occupations, as in the manufacture of fertilizers, the management of dairies or creameries, the editing of newspapers, or in teaching. It is a fact that the number of graduates from the agricultural courses is too small, even now, to make it possible for the various institutions to secure enough competent instructors, hence the number of men who have been educated in these colleges, and who are engaged in farming, is too small to directly affect agricultural practice in the various States. The wonder is, therefore, that any genuine progress has been made, rather than that greater progress has not been made. Our progress can be accounted for by the wealth of our natural resources, a progress that has been accompanied by woeful waste.

That this would apply to any other industry which has made proportionately greater progress than has been made in farming is true in a sense, but it must be remembered that in other industrial lines there are many schools where technical education may be obtained, whereas in the case of the farmer his only school, practically, is his agricultural college, though fortunately there are a few notable exceptions. The only means of education available to him aside from his agricultural college may be found in the various subordinate agencies, such as the farmers' institutes, the grange, the press, the State boards of agriculture, the agricultural and horticultural societies, and farmers' clubs, and the direct influence of these is really quite limited. The farmers' institutes, which are directly educational in their methods, according to available statistics reach less than 5 per cent of those living upon farms, and these attend institutes because they are already in touch with the experiment stations; they do not reach, as a rule, those who are in the greatest need.

I do not desire in any way to belittle the very great service that has been rendered by these organizations, for I appreciate fully their value, but it can not be claimed even by the broadest [illegible] of the term "education" that they have been truly educational [illegible] that the college or school is, where prescribed studies are [illegible] pursued in a logical way. It is impossible to achieve great [illegible] economic and general progress in any calling, without laying [illegible] interested as educated and trained in the fundamental principles upon which the industry rests as to enable them to agree as a unit upon essentials.

It may be said also that this education of which we speak is not selfish in its character, for while it concerns directly the farmer and the farmer's interests, the actual result of the broader dissemination of exact knowledge will ultimately redound to the benefit of the entire people engaged in whatever line of industry. This doubtless is true in a degree of all forms of education. Nevertheless it seems to me that this education, which is so intimately related to the issues of life, must be considered of relatively greater importance than any other, for it is, in the long run, a prerequisite either to the material enjoyment or to the usefulness of man, whatever his education may have been in other directions. This view is based upon the fact that the capital stock of any country, and, therefore, its present and prospective wealth, as well as the means whereby the wealth may be utilized for the uplifting of mankind, lies in the natural resources of that country. In an agricultural country these resources are in the soil, and since the value of the soil, or its sustained power to produce crops, is measured by the content of nitrogen, phosphoric acid, and potash, together with the conditions which make them available to plants, it follows that the future progress of that country is measured by the intelligence with which these constituent elements are used. The wasteful use of these, either in the systems of farm practice adopted or in the crude transformations that take place in their manufacture and distribution, must reduce the possible value of the resources, and, therefore, the adequate return in culture or material wealth, which alone permits of these enjoyments accompanying a higher civilization.

It is a notorious fact that the farm practice in this country up to the present time has been wasteful in all these directions, and while this wasteful practice can not be charged exclusively to ignorance on the part of the farmers themselves, the result is identical, and unless we increase our knowledge of the means by which the natural forces which are always active may be understood and controlled by the mass of farmers, the time is not far distant when this country, in common with older countries, will be confronted with the problem of feeding the people.

I am well aware that these natural forces of sun, air, water, and temperature, and the principles upon which the sciences of geology, of chemistry, of biology, and of physics are based, and which are all concerned in the proper utilization of these constituents of our soils, and consequently the true progress of the nation, have existed since the beginning of time. Real progress in their application was not apparent, however, until the investigations of the geologist, the chemist, the botanist, and the physicist had established a reasonable basis for a theory that would account for the various phenomena involved in the work, and it is through the broader dissemination of the results of the work of these investigators in other countries that the latter have been enabled to maintain and increase the fertility of their soils and to provide a larger measure for the feeding of their people. The conservation of those basic elements in the countries in question is partly facilitated, too, by the disregard of these principles in our country. There is, I admit, no immediate danger of a shortage of agricultural products in this country; neither is there any immediate danger of a general dissemination of knowledge that will result in materially changing our farm practice. It is a gradual process in either case, but unless more active measures be taken and strenuous efforts made to provide for the future, the rate of progress made by our nation in all those directions, which has made us truly great, will be materially reduced.

Aside from the primary problem of producing crops, and of conserving at the same time the principal elements involved in their growth, we must recognize that the allied problems of labor, transportation, social conditions, political and economic forces, which create so much dissatisfaction and unrest among the farmers, as among others, are the result, in part at least, of the ignorance of the fundamental principles upon which the industry rests. It is a common saying that farming as a business depends more upon the man than upon the conditions, and if we will follow up this matter we shall find that where the individual is successful, he is so because he has either by intuition or force of
succeeded in educating himself. He has acquired, by his experience
ct with men, those attributes which compel success, which the agri-
ollege is destined to give. Take the question of labor, which is such
ant problem at the present time in our Eastern States and in the
large cities in all sections of the country. There can be no good

reason, if economic conditions were properly adjusted, why the farming business should not fairly compete in obtaining labor with the manufacturer, whose business it is to prepare for consumption the products which the farmer raises; and yet if the farmer were to pay the same relative rate of wages and grant to labor the same number of hours that are maintained in the mills he would not be able to earn living wages for himself, much less secure the profit which the manufacturers demand. John Mitchell, the celebrated labor leader, stated in the public prints a few weeks ago that "labor was the only commodity which permitted the person using it to fix the price for it, and that he proposed in the new arrangements that were to be made that the laborer should fix the price of his labor, just as the manufacturer fixed the price of his manufactured product." This would seem a reasonable demand, yet John Mitchell ignored the fact that these men, occupying more than 5,000,000 of farms, were doing exactly what he claimed was being done only in the case of labor. The farmer seldom fixes the price of his produce; never in the case of many perishable products. It is fixed by the purchaser, and presumably based upon the conditions of demand and supply. If this were actually the case, no legitimate criticism could be made, but the facts are that in too many instances prices are fixed by those possessing superior advantages in the way of capital or intelligence, and without special reference to supply and demand. The producers on these millions of farms should have a share in these adjustments in proportion to their interests, and would be able to exercise a proper and legitimate influence if made familiar with the principles that are involved.

In the matter of transportation, too, it would seem that if economic conditions were properly adjusted more equitable terms for the distribution of the products of the farm would be provided. Transportation companies depend for their income to a greater degree upon the products of the farm, in both the raw and manufactured state, than upon the products of any other industry. The tonnage of corn, wheat, hay, and cotton greatly exceeds that of iron, coal, or oil; yet there are no rebates or cut rates offered the farmer. He is charged all the traffic will bear. One of the chief causes of the depression of agriculture in many sections of our country, and especially in our Eastern States, which are within a short distance of our large cities, is the cost of transportation. It is not possible to have perishable products transported in such a way as to enable them to reach the consumer at a cost and in a condition that would allow the producer to compete with products that are raised upon lands located at greater distances from points of consumption. Concrete examples of the influence of definite knowledge in changing conditions in many of these respects, I have no doubt, are familiar to all, as they are to be found in any State, and only illustrate the beneficent results of its broader dissemination.

The social conditions existing in many, if not all, farming communities also need to be improved. The advantages to be derived from education accrue only when the social nature of man is properly provided for. The farmer now is, in many instances, content to make money on the farm, but is not content with it as a home for his family. In fact, many use it as a means of securing a competence that would enable them to live elsewhere.

All of these problems, which affect, both directly and indirectly, the true progress of agriculture, and in a sense the stability of our Government, can be solved and will be solved in a satisfactory manner only when the essential principles which are involved are understood by the masses engaged in the work.

The agricultural colleges must recognize the gravity of these problems and give their moral support, not only, but should be the leaders in solving them. They must be in such close touch with the educational facilities of the various States as to make it possible for the boy on the farm to obtain an elementary knowledge of his business and likewise of its relation to all the other, in a sense, subordinate industries. I do not wish to be understood as saying that the colleges should interfere with things that do not concern them, but rather that they should take such an interest in all these problems as shall promote the proper education of the large number of men engaged in the work. In order that this may be partly met, many institutions have established short courses in agriculture, where it is possible for students to obtain a certain amount of knowledge, good as far as it goes and deserving of encouragement. The college should not be content with this, however, as it can not be regarded as the best and only thing they can do outside of their regular work; first, because it is not possible thus to reach all the farmers; second, because it is not true education and is not far-reaching enough to enable the student to master his opportunities like one who is surrounded from his earliest school days with an atmosphere of instruction, where not merely the proper general knowledge is supplied, but where the knowledge gained points constantly to the farm. The instruction, which is given by means of the farmers' institutes and which is now available in nearly every State in the Union, is to be highly commended and should receive the support of the college; yet also this work is not strictly educational; besides the institutes do not reach, as a rule, that class which is in the greatest need of advice and instruction. The agricultural press is a mighty force, and if properly directed is of very great service, yet this likewise is not an educational factor in its true sense. The skilled workman in other industrial lines does not regard his trade journal as a source of education, but rather as a source of information as to the progress that is being made in his profession. It is not possible by any of these means to acquire the sort of education which may come from the elementary or high schools. Such education will come only when those interested in the higher education will see to it that sound learning is provided in all grades.

The colleges also have a direct responsibility as to the kind and amount of work that shall be done by the experiment station, while on the other hand, the experiment stations have a direct responsibility in providing the colleges with accurate data for the instruction that shall be given in the various branches. The responsibility of the colleges is much greater, therefore, than that involved in the question of the number of hours that an experiment station officer shall teach in the college. This question is important, however, not only because the institutions are absolutely distinct, in so far as their incomes are concerned, but because the work of each is specifically prescribed in the laws establishing them. It is quite possible that an exact division of time and salary may be made, and yet the purpose of the appointment of the experiment-station officer be defeated simply because it is not a question of equivalents as to division of time and proportionate payment of salary. It is a fact that the progress made by the colleges is coincident in many instances with the establishment of the experiment station. This is no discredit to the college, nor is it to be regarded as a matter of great credit to the experiment stations. It was rather a matter of conditions, emphasizing more strongly than arguments the question of the interdependent relations of the two institutions, the one supplementing the work of the other. The colleges were not in a position to come in touch with the farmers; the experiment stations were, and hence the growth of the colleges has been, in a degree, proportionate to the effectiveness of the work of the experiment stations. The stations, like the college, have their work defined in the laws establishing them, and because the provisions of the law are capable of a broad interpretation, the character of the work that shall be done is left largely with the individual institutions.

The primary function of the experiment station is, however, not to teach, but to conduct experiments which shall secure and establish facts and principles that broaden the sciences upon which the practice of agriculture is built, and shall thus ultimately remove in large part the uncertainty now involved in its pursuit, which leads to the waste of much energy and involves vast financial losses. The work in question is broad and complex, and concerns not merely the raising of the crude products, and likewise their conversion into merchantable forms, but also the transformation of vegetable into animal products, and their further change into still finer forms. With the varying conditions that exist in the different States in respect to the soil, climate, and season, and location in reference to markets, the problems for study are almost innumerable, and thus call for broadly trained men who shall not only be capable of wisely selecting lines of investigation, but shall also be able to plan and carry on investigations in a highly scientific manner.

There may or may not be any marked significance in the first paragraph of the second section of the Hatch Act, which says "that it shall be the object and duty of said experiment stations to conduct original researches and verify experiments and publish results," etc. It is abundantly evident, however, from a careful study of the work that has been carried out by the various stations, that the lines of investigation specified in terms more or less exact have more largely occupied the attention of the stations than original researches. They have taken up the work of the various States that seemed to be of the most immediate importance, which, though not in all cases strictly scientific, has furnished a basis for broader work in the future, while at the same time it has been of direct service to many in modifying methods of farm practice and of indirect benefit, not only to the farmers in the State in which the station was established, but in many instances in all the States of the Union.

Prior to the establishment of the stations there was no opportunity for the farmers to see how science might be applied to practice, and the great progress that has been made in farming, particularly in the use of commercial fertilizers, the saving of farm manures, the improvement of crop rotations, the feeding of cattle for milk and beef, the improvement of pure breeds of animals, the introduction of new and better varieties of cereal and forage plants, the manufacture of dairy products, and the adoption of business methods, have been due to the work of the experiment stations in demonstrating by analysis and control experiments the economies that may be derived from the application of such science. The station's influence, therefore, has been thus far rather educational than investigational, though, as already pointed out, the former must necessarily precede the latter, and when the colleges shall have attained to their full influence the necessity for the educational side of experiment-station work will have largely disappeared.

In other words, the stations have passed through the various stages through which all new institutions must pass before reaching that degree of stability which will enable them to broaden their work, and, from the farmer's point of view, take up that which may seem to be of little immediate practical service. Many stations are now conducting original researches of a very important character, and of the greatest promise in the ultimate usefulness of the data obtained, and at no time in the history of the stations has there been a greater need for highly-trained men of the character above described. It is the manifest duty of this association, as representing both the colleges and the stations, to see to it that provision is made for the specific training of investigators; for, all things considered, our progress has been measured and its limits fixed by the men available, rather than by material equipment.

But when we compare the progress that has been made in the acquiring of new facts through original research, we find that we have not progressed very far. In the domain of chemistry the chief progress has been in the perfecting of methods of analysis and in the application of the facts already well known, rather than in the establishing of principles of fundamental importance. The same is largely true of the other sciences related to agriculture. Such new facts as have been gained have not contributed materially to the development of that particular science. Much has been learned of ways and means in themselves of great service, to be sure, yet these were hardly the result of deep scientific research.

The stations are confronted to-day, though perhaps in a less degree, with the same conditions that confronted them in their establishment in 1887, in reference to many problems, the solution of which is of the highest economic value. We daily witness large areas of our soils lying idle and unproductive because we do not know what to do with them. We are powerless to prevent losses of fertility from our soils because the causes of loss and means of prevention are unknown. We appreciate the importance of providing the crops with the right kinds and proportions of plant food, and yet see money and energy wasted because we are unable to give advice that shall be of service in conserving and making available the essential constituents. The farmers are subjected annually to stupendous losses of live stock because we can not correctly diagnose disease and suggest methods of prevention or provide a positive remedy. The depredations of pernicious insects and plant diseases still cause the farmers to groan in spirit, because suggested remedies are in many cases ineffective. I cite these facts, not in a spirit of criticism, nor for our discouragement, but rather that we may be incited to greater activity in providing for and promoting those lines of work which shall broaden the foundations upon which the science of agriculture rests. We are engaged in a great work, the importance of which in all its relations it is impossible to adequately express in words. It remains for us who have been so signally honored as to be thought worthy to participate in it to live up to the high ideals set for us in the beginning, the pursuit of which has resulted in broadening the influence and increasing the helpfulness of the institutions represented in this association.

At 10 o'clock p. m. the convention adjourned to meet at 9.30 o'clock a. m., November 15, 1905.

MORNING SESSION, WEDNESDAY, NOVEMBER 15, 1905.

The convention was called to order at 9.30 o'clock a. m. by the president, E. B. Voorhees, of New Jersey.

H. C. White, of Georgia, announced the order of business for the day recommended by the executive committee, which was accepted without discussion.

H. C. White also announced that, on account of death in his family, Prof. L. D. Harvey, of Menomonie, Wis., asked to be excused from presenting the paper on "The relation of the agricultural colleges to industrial education in its elementary and secondary phases," which he had agreed to prepare for this convention of the association.

On motion of Doctor White, the association extended to Professor Harvey the expression of its regret that he could not keep his engagement, and its sympathy in the sorrow that had come to him.

REPORT OF COMMITTEE ON METHODS OF TEACHING AGRICULTURE.

The report of the committee on this subject was read by A. C. True, as follows:

At the meeting of this association in Washington in 1903 there seemed to be a desire to have the committee on methods of teaching agriculture investigate and report on the feasibility of teaching agriculture in the rural schools. Your committee made such an investigation and embodied its results, along with suggestions on the nature and extent of such teaching, in a report presented at the Des Moines meeting. This report was published as Circular 60 of the Office of Experiment Stations, and later was embodied in the proceedings of this association. The first edition of Circular 60 (5,000 copies) was exhausted in less than six weeks, in another month the second edition of 5,000 was gone, and at the present time only 3,500 copies remain of an edition of 10,000 issued March 27. As a result of sending the circular to the State superintendents of education, requests were received to send it to several thousand county, township, and city superintendents of schools. The circular was frequently referred to and portions of it quoted by agricultural and educational journals, and that part of the report designated "Syllabus of Elementary Course in Agriculture" was embodied in the very important and comprehensive report of the committee of five of the National Educational Association on industrial education in schools for rural communities.

The widespread interest thus indicated in the teaching of agriculture in the public schools led your committee to continue its investigations along this line with a view of reporting on the availability of illustrative material and exercises for the use of teachers and pupils in school agriculture. The agricultural extension officers in a number of the land-grant colleges were consulted. Schools in which agriculture is being taught were visited, and the text-books and other literature prepared for the use of public schools were collected and studied. As a result of this work your committee has arrived at the conclusion that there is an abundance of suitable material with carefully prepared suggestions for its use in illustrating the principles upon which the science of agriculture is based. But this material is scattered through many text-books, bulletins, and circulars of information, and as a natural result the exercises lack cohesion. They are not arranged in progressive series and they are neither available nor suitable for general use in the public schools throughout the United States.

Furthermore, many of the best exercises are embodied in publications issued by agricultural colleges or State departments of education, and their distribution is limited by law to the States in which they are printed. Your committee is of the opinion, therefore, that this material should be brought together and subjected to a thorough sifting process. Unsuitable material should be discarded; exercises which are suitable for school use in their present form should be published with due credit to their authors; those needing revision should be worked over, new exercises should be prepared to fill in gaps, and finally all of this material should be pedagogically arranged, suitably illustrated, and published in such form that it can be used to supplement the textbook of agriculture in the public schools. There should also be a careful study of the apparatus and materials needed in connection with the exercises outlined, and a list of these and their probable cost should be published.

Considerable progress has been made during the past year in getting together material for a report on this subject such as your committee desires to present, but some time must necessarily elapse before it will be in form for publication. Your committee therefore proposes to negotiate with the Office of Experiment Stations to prepare such a report as has been suggested herewith and publish it for general distribution throughout the United States.

The committee proposes to continue its work during the next year in two lines: (1) A study of courses in agriculture for agricultural high schools and other secondary schools, and (2) the more detailed formulation and discussion of college courses in animal husbandry to supplement the general outline of courses in this subject already published.

A. C. True,
T. F. Hunt,
H. T. French,
H. H. Wing,
J. F. Duggar,
Committee.

H. T. French, of Idaho. Before this report is finally disposed of I would like to call upon Doctor True to give us some further statement as to the work of the Office of Experiment Stations in connection with this report and the former reports that have been made.

A. C. True. The Office of Experiment Stations, as you all know, was established primarily to aid the experiment stations in various ways, and has naturally become a sort of clearing house for the experiment-station movement in this country. The fact that these stations were departments of the agricultural colleges, and that the work of the stations themselves was very intimately connected with the development of the courses of instruction in the agricultural colleges, naturally led the Office to take up, at the request of individuals and institutions, work relating more directly to agricultural education; and with the progress of the movement for agricultural education in a broader way, the Office has naturally broadened its work. This has been especially true since the formation by this association of the committee on methods of teaching agriculture, the director of that Office having been made a member of that committee.

This work has gone on until we have been drawn into connection with the general movement for agricultural education in such a way that the demands on us for work in different lines are so large that under present conditions the matter is somewhat of an embarrassment because we are not able to meet those demands. Through the action of this association and the work of the committee on methods of teaching, as well as the work that has been done in connection with the expositions, particularly the St. Louis Exposition, the Office has now a considerable number of publications on agricultural education, and it has become recognized in the country to a very considerable extent as an agency for the promotion of agricultural education. The result is that not only are the institutions represented in this association making appeals to us to aid in this direction, but we are getting appeals in the same way from other organizations, from the State and county superintendents of education, and a large number of teachers, as well as from organizations which represent the interest of the agricultural people in this matter. Now, if this work is to go on effectively, I think that we must have the cooperation of this association with reference to its development. At present the work is done as an incidental matter. There is no provision in the law expressly for such work, nor have we any organization for the work beyond the employment of one officer who gives a part of his time to the work, and represents it in the Office. I refer now to

Mr. Crosby, who is in charge especially of the matters relating to agricultural education, although the rest of the office force, so far as they can, assist in that work.

Now, it has seemed to me that if it is desirable that the Office should continue this work, and develop it according to the demand, we must have the work recognized by law, and must have some definite provision for it; and so I have asked the Secretary of Agriculture in making up his estimates this year to word the appropriation bill so as to provide for this work, and also to estimate a certain amount for it, and that he has done. The proposition is to add to that provision of the appropriation act which allows us to undertake work in connection with the farmers' institutes simply the words "and agricultural schools." It will then be recognized in the law that we are to work for the promotion of agricultural schools as well as the farmers' institutes. Of course the term "agricultural schools" we shall interpret broadly to include institutions that are engaged in instruction in agriculture. The amount asked for is $5,000, which it seems to me is a sufficiently modest sum for work of that kind if it is to be made at all efficient.

I think that in view of the interest in this matter that seems to be expressed here in a general way it is desirable that the association should understand just the situation. From our point of view it is certainly desirable that this matter should be in some way effectively brought to an issue and decided by Congress. I ought to say, perhaps, in this connection, that we have endeavored to manage this work in such a way as not in any way to interfere with the work that the Office has undertaken in other lines. You will perhaps remember that at some previous meeting—I do not remember whether at Des Moines or before that—the association expressed itself with reference to the extension of the work which the Office is doing on the Experiment Station Record, and that has been kept steadily in mind. We have received a small increase in our appropriation; I think last year we got about $2,500 more in the general appropriation than we had previously. And just as far as possible we are endeavoring to meet the desire of the association in matters relating to the Experiment Station Record. In order to make that publication more comprehensive and at the same time limit its work more distinctly to the lines of agricultural science, we have this year made a somewhat different arrangement of the departments and have increased the staff of the Record so as to have editors specifically for the departments of rural engineering, rural economics, and agricultural education. Those matters had been previously treated of more or less in the Record, but now they will receive more space and matters relating to them will be more definitely followed. So that we are endeavoring not to neglect the work for which we were primarily established. But this matter of agricultural education is particularly pressing just now, and if the work is to be put on a definite basis we need the cooperation and support of the friends of agricultural education wherever we can find them.

The report was accepted.

REPORT OF COMMITTEE ON GRADUATE STUDY.

A report from the committee on this subject was read by L. H. Bailey, chairman, as follows:

The first graduate school of agriculture, held in the summer of 1902, was conducted under the auspices of the Ohio State University and with the cooperation of the United States Department of Agriculture and the Association of American Agricultural Colleges and Experiment Stations. The success of that school has led the Association of American Agricultural Colleges and Experiment Stations to instruct its committee on graduate study to consider the question of holding other schools of similar character. At its meeting in Des Moines the association reaffirmed its conviction that a graduate school of agriculture is a desirable enterprise to be conducted in the summer at different colleges of agriculture in rotation, and expressed its desire that this school be held every two years.

The committee on graduate study was empowered to determine where such schools shall be held, and also to request each agricultural college to contribute the sum of, say, $25 annually to aid in the maintenance of such school. The committee reports that arrangements have been concluded whereby the school is to be held at the University of Illinois in the summer of 1906. It has also asked each of the agricultural colleges whether it could contribute $25 each year in aid of a graduate school. Affirmative responses have been received from 27 institutions, and negative responses from 15. Four of the institutions have expressed doubt as to their ability to contribute, and 3 have not responded. Omitting the University of Illinois, at which the forthcoming school is to be held, there remain 26 positive affirmative replies, making an annual assured contribution at this time of $650, or $1,300 for the biennium.

Your committee finds itself without definite powers in respect to the graduate school beyond the two items of business mentioned above. The nature of the powers delegated to this committee will determine the attitude of the association toward the graduate school, and the measure of responsibility that it desires to assume. Your committee believes that a graduate school is exceedingly important for the purpose of aiding the officers in colleges and experiment stations in keeping in touch with current progress, of concreting and harmonizing the work of these institutions, of developing friendships, and of inspiring enthusiasm. It believes that the maintaining of a graduate school should be a regular and continuing work of this association. Your committee therefore makes the following propositions for your consideration:

(*a*) The Graduate School of Agriculture is an institution of this association.

(*b*) It follows, therefore, that the policy and method of the school are to be determined by the association, and that the institution at which the school is held in any year is to be the agent of this association.

If these propositions are adopted, then the committee on graduate study (or some other committee created by the association) must be empowered to provide for the financial and pedagogical policies and conduct of the school. The committee recommends that:

(1) The moneys contributed by the different institutions in aid of the school shall be paid to the treasurer of this association and by him be paid over to the institution at which the school is held.

(2) The expenditures of these moneys shall be with the advice and consent of the committee on graduate study.

(3) The institution at which the school is held be requested to make to this association, for the information of the association and of such institutions as may care to conduct such a school, a statement of the expenditures in the interest of the school, not only of such funds as are derived from contributions, but also from fees and appropriations by the institution itself.

(4) The committee on graduate study, by and with the concurrence of the president of the institution at which the school is held, shall choose a dean of such school, and shall, either through the dean or otherwise, and with the concurrence of the institution, choose the faculty and determine the course of study.

(5) All local arrangements and all work of publicity lie with the institution holding the school.

(6) The committee be empowered to solicit funds from experiment stations as well as from colleges, when such stations are under management separate from the colleges, and also from State departments of agriculture and other organizations if it should seem wise to do so.

L. H. BAILEY,
M. H. BUCKHAM,
A. C. TRUE,
W. O. THOMPSON,
B. AYRES,
Committee.

On motion of the chairman of the executive committee, the discussion of the report was proceeded with at once.

L. H. BAILEY, of New York. There are two fundamental propositions which should be discussed, I think, before we proceed to the details of the organization and conduct of the proposed school. The first is that the graduate school of agriculture is an institution of this association; that this association is responsible for it; that it is the creature of this organization. If this be true, it follows, therefore, that the policy and the method of the school are to be determined by the association, and that the institution at which the school is held in any year is to be the agent of this association.

The financial maintenance of this school would come from three sources, so far as the committee now foresees. In the first place from the contributions by the colleges, and, in the second place, from the fees. At the graduate school at Columbus three years ago the fees were placed at $6, for the reason that other fees in other summer school work were placed at that. The committee believes that a fee of $10 would be fair and reasonable. At the Ohio school there were 75 matriculants. We should expect there would be 100 at a succeeding school, and at $10 apiece that would make $1,000, the remainder of the fund to be contributed by the institution that holds the school. The committee feels that some maximum limit might be placed on the cost of the graduate school. That maximum limit has not been fixed nor definitely discussed. It has been suggested that $4,000 might be the maximum.

I think that the association should assume financial responsibility only so far as its contributions are concerned. The contributions paid into the treasury of this association become the contributions of the association. But the committee feels that the financial responsibility of this association does not extend beyond the contributions.

The reason for the provision for the biennial session is that this association at Des Moines expressed its opinion that the graduate schools should be held every two years. The committee therefore worked upon that instruction. I think the committee, however, is unanimous in the feeling that this is frequent enough, and that a school could not possibly be maintained every year at the high pitch and grade at which it is desirable to maintain it.

The next proposition is merely a corollary of this, or at least a consequence of this, for it follows that the policy and method of the school are to be determined by the association, and that the institution at which the school is held in any year is to be the agent of the association.

After further discussion by E. Davenport, of Illinois; D. B. Purinton, of West Virginia, and E. A. Bryan, of Washington, a motion made by G. T. Winston, of North Carolina, that the report of the committee as a whole be adopted by the association, and that the committee be authorized and instructed to proceed to organization of the graduate school for the year 1906, according to the lines laid down in the report, was agreed to.

REPORT OF COMMITTEE ON PURE-FOOD LEGISLATION.

A report from the committee on this subject was presented by the chairman, W. A. Withers, of North Carolina, as follows:

During the past year Maine and New Hampshire have enacted pure-food laws. Missouri and Wyoming have each appointed a food and dairy commissioner to whom is intrusted the execution of pure-food laws. Kansas has made a beginning by authorizing the board of health to collect samples and the professor of chemistry in the State university to make analyses of the same; but no appropriation for the work has been made. Indiana has made an appropriation and has established a laboratory, and by these means will enforce existing laws. In North Dakota and Idaho there has been a strengthening of existing laws. In other States existing laws have been amended without any very apparent gain. But in no State has any pure-food law been repealed except by the enactment of new laws.

Progress has been made in the different States, therefore, (1) by establishing a food control in States previously without it, (2) by the creation of machinery, or by making an appropriation for rendering existing laws effective, (3) by enacting laws without appropriations and making the work in so far as it is done a gratuity, and (4) by amendments which tend to strengthen existing laws or to secure greater uniformity.

The results which have attended the inspection by the United States Department of Agriculture of imported foods under existing laws of Congress illustrate the good effects which would follow the enactment of a law regulating interstate commerce in adulterated and misbranded foods, beverages, and drugs. It was thought in some quarters that this inspection would hinder or diminish foreign commerce in food products. The experience of two years of inspection, however, has shown that this fear is groundless. On the contrary, trade in inspected products has greatly increased. Purchasers, feeling that imported goods, such as olive oil, etc., have been inspected and are pure, are buying in larger quantities than ever before. This confidence of the public in the character of imported goods will be extended to those of domestic origin subject to interstate commerce, when a national law regulating interstate commerce is passed and enforced.

Such a law will be of immense advantage also in urging to uniformity the laws and regulations of the various States, thus relieving manufacturers of a great deal of annoyance, without in any way diminishing the protection afforded to the consumer.

Your committee, therefore, respectfully urges the association to take such action as will look to the indorsement of a pure-food measure, its introduction to Congress, and its enactment in law.

Messrs. Wheeler, Patterson, and Withers ask to be relieved of further service upon this committee, as their work is not connected with the food control.

W. A. Withers,
H. J. Patterson,
H. J. Wheeler,
Committee.

Instructions to the Executive Committee Regarding Congressional Legislation.

The following recommendation of the executive committee was laid before the convention for consideration by the chairman of the committee, H. C. White:

Your committee submits to the association, in view of the efforts which will be required in connection with the proposition which will be made to increase the appropriation to the experiment stations, whether it would not be wise to withhold for the present specific instructions to your executive committee in connection with the mining school bill, leaving the committee free to concentrate its efforts to secure the passage of the Adams bill, giving, of course, to the mining school bill, if introduced, such support as may be practicable or conditions justify.

H. C. White, of Georgia. In connection with that recommendation, the resolution offered by President Atherton (p. 28) covers the case largely, and the executive committee reports back this resolution for consideration at this time with an amendment. The recommendation of President Atherton, with the amendment by the executive committee, reads as follows:

Resolved, That the executive committee be, and hereby is, instructed to use its best efforts to promote the passage of the Adams bill; and

Resolved, That this association hereby reindorses the Mondell bill and advises the executive committee to give such assistance to its passage as, in its judgment, may be advisable and as circumstances may justify.

The adoption of this resolution would be substantially the adoption of the recommendation of the executive committee. If the association should continue to give instructions to its executive committee to urge the passage of specific bills, as, for example, a bill known as the "Adams bill," a bill known as the "Mondell bill," a bill known as the "Hepburn bill,—which you have just indorsed—a bill in connection with forestry, and so forth, that would scatter the efforts of the executive committee to such an exent that they would be futile in all cases probably. Now, to avoid minimizing the influence of the association your committee has suggested that you consider the propriety of restricting these instructions to the executive committee, asking it to concentrate its efforts on some particular measure. That is the question now, whether it should be the policy of the association to restrict its instructions to the executive committee so as to enable the committee to concentrate its efforts on some line of legislation, and that we understand to be the effect of President Atherton's resolutions that it is the sense of the association that the efforts of the committee be concentrated.

W. O. THOMPSON, of Ohio. I do not understand that the executive committee is asking us to concentrate on the Mondell bill or any other bill, but they are asking us whether or not this association should not say to them, " We desire you to concentrate your efforts upon some specific thing in the hope of success." The question before the association, if I understand it, is now really on the general policy, whether we shall aim for one thing or go out for everything in sight; and the judgment of the executive committee seems to be that if we go out for everything in sight we will come back with nothing; whereas if we go for one thing we may get it, or we may not. Now, there may be a difference of opinion on what we should go for, but the important issue is that we should concentrate our efforts upon some particular thing.

E. DAVENPORT, of Illinois. My view is that we should not bind this committee down too closely. If we instruct the committee to do one thing, it may be found to be something that can not be done. There are three or four pieces of legislation that we want to see adopted as soon as possible, and it seems to me that if we surround our committee with ironclad instructions each year, those instructions may stand in the way of achieving some other thing that might be brought about. If a particular bill is now in favorable form for passage, at the coming session of Congress, and we think that is most likely to pass, and we instruct our committee to work for that, it may very well be that that bill can not pass, and that some other bill may pass. Therefore I am in favor of intrusting our executive committee with a considerable degree of discretion, allowing them to use their own judgment as to where to put the pressure and the work when the time comes.

G. T. WINSTON, of North Carolina. I thought there were some specific recommendations made by the executive committee in regard to the Adams bill, and then in regard to the Mondell bill. If it is only the general recommendation that we should concentrate our efforts, I do not desire to ask for a division of the vote on the question. If, however, we are to vote for the Mondell bill, I would like more information as to the present condition of that bill, for I am frank to say that I am not satisfied with that bill as I last saw it, and I do not think that the association would be satisfied with that bill if it fully understood. It seems to me that the time has come for this association to assert itself in protecting the interests of the colleges and the kind of education which this association, as I understand it, was formed to protect and promote. I think there is danger that the great interests and the great ideals of education represented by this association are going to be interfered with and checked and obstructed by other influences and by other interests and by other ideals of education. If a bill for the establishment of mining schools in connection with land-grant colleges is to be so framed that institutions which have no mining departments are able to secure the benefits of the appropriations, and so divert them from their proper channels, why can not the same thing be done with any other school—a forestry school for instance? And, then, why not go back and deal with appropriations and institutions already existing? I see no reason why this should not be done. It is the principle that I oppose.

I hope that this association will not indorse the Mondell bill in its present shape, and whether we get it or do not get it, let us stand upon a principle.

H. C. **White.** The motion before the house is not on the question of indorsing one thing or another. The motion before the house is on the question whether the convention will declare its policy as to concentration. The resolutions of Doctor Atherton, which have come in subsequently, provide for specific instructions in regard to the Adams bill and general advice in regard to the Mondell bill. Those resolutions, however, are not now before the convention. The question is now on the motion of Dean Davenport that the recommendation of the executive committee be adopted, and that it shall be the policy of the executive committee to concentrate their efforts rather than diffuse them.

J. K. **Patterson**, of Kentucky. I have no scruples whatever about going before the Congress of the United States and asking for what our agricultural and mechanical colleges need. They get the money from the people, and it is their function to disburse to the best advantage this money for the benefit of the Republic. I have a perfect right, and this association has a perfect right, to go before Congress and ask whatever it wants and whatever it needs, and I do not think that it need have any compunction because of States' rights or any other sort of rights. The money in the Public Treasury belongs to the people, and if we can induce Congress to believe that they are making a proper use of the means at their disposal in fostering and supporting these land-grant colleges along the lines originally indicated in the organic act, that is all right. Now, I am interested in the passage of this Adams bill. I believe that the experiment stations ought to be strengthened; and I do not believe that we are in any danger of asking for too much in this direction. But I am equally interested in the passage of a measure of some kind that will give strength to the other side of the provision made for the establishment of these colleges, namely, in the direction of mines and mining, which seems to me to be a legitimate outcome, a legitimate corollary, from the original establishment of colleges for the study of agriculture and instruction in the mechanic arts.

Now, every State in the Union is interested in the passage of a mining bill. We are interested in it, and have made repeated efforts to get it through. It is going to come up again this time, whether we will or not. If it is not introduced under the auspices of this association, it will be under the auspices of one or two other associations, and they are working diligently to accomplish their end. Some of us who attended the meetings of the Association of State Universities the other day were also allowed to attend a meeting of the Mining Association. The Mondell bill was presented in a modified form, and after the criticisms of President Atherton and others it was agreed that that was a bill which not only harmonized the interests of this association, but also harmonized the interests of this association with other interests outside of it.

Now, whether we will or not, a measure is going to be introduced, and if it is not introduced with our cooperation, and if in consequence of our opposition we take no part in the movement, if we even are neutral in the matter, our interests may suffer. This bill was believed, after it was recast, to be acceptable to all concerned. It was accepted by the Mining Association; it was accepted unanimously by the presidents of the colleges and universities outside of this association who were present yesterday and who adjourned yesterday. It seems to me that it would be folly for us to withhold our active cooperation in this matter. We may not be the introducers of the bill, but if that bill be introduced by other parties, as it certainly will be by these two other associations, it is just possible if we give it the cold shoulder, or betray an attitude of neutrality—whether active or not—it will be passed to our detriment. We ought not to be placed in that attitude. If we believe that that bill sufficiently guards our interests, if it is not in any important sense antagonistic to our interests, though we do not get all we would otherwise get if it was introduced by ourselves and there was nobody else to thwart us, then we ought to give it our hearty cooperation and our effective cooperation.

Now every State in the Union is interested in this matter. Even Maine is interested in it; and Florida is interested; and a great many of those States which have infant mining industries now are interested in it. The State of Kentucky is especially interested in it, and we expect to work earnestly in conjunction with whoever introduces this bill, believing that in whatever shape it passes now we are anxious to cooperate as beneficiaries, to cooperate in placing it upon the statute books of these United States. I believe that ought to be the attitude of every one of our orgänizaions. If we can not get all we want, take all we can get. Half a loaf is better than no bread. And if there are antagonistic interests which come into the arena, concede a little now, in order that you may be able to get your opponents to concede a little on the other side, and bye and bye a bill will be produced, some such bill as this that was read the other night and was submitted to these associations, which will benefit very largely all the interests. I scrutinized that bill pretty carefully, and I believe that in the main the agricultural and mechanical colleges which compose this organization will be benefited. This is a matter of extreme interest to us and to all the institutions in the nation. The agricultural interests are now and for a long time will be predominant; but there are other interests that are coming to the front very largely and which will in the end be potent rivals of the agricultural production of the United States of America. More than 100,000,000 pounds of copper are mined here every year and sent abroad to be manufactured abroad and to come back here for us to buy. Why might not these industries be developed to such an extent as to enable us to utilize them at home? There are billions of tons of coal that only await the industrial energy and intelligence of the mining engineer to be brought to the surface and to add immensely to the wealth of this country; in iron and copper and silver and gold there are billions of tons in the bowels of the earth that are only awaiting their development. Now, how can this be better accomplished than by adding to the facilities of those mechanical branches of learning that are now taught in connection with these land-grant colleges, placing this mining instruction and education right there, so that, by cooperation with these other elements, provision for which is made along the scientific lines, the greatest amount of energy may be brought to bear, thus bringing together a concentration of capital and a diffusion of labor that will yield the greatest possible results? Just in connection with these agricultural and mechanical colleges ought these schools of mines to be established; and this Mondell bill, I seriously and earnestly believe to be instrumental in bringing about that same result. If we attempt to bring it about ourselves and ignore the cooperation of each other's interests, we shall fail. If the Association of State Mining Schools attempts to do it without the cooperation of the other two associations, they will fail. And if the third one attempts to carry that measure through Congress, they will fail, whether through our opposition or our apathy. But when we all put our shoulders to the wheel, the appropriation will be secured, and in nine cases out of ten it will go where it ought to go, namely, to the agricultural and mechanical colleges.

E. Davenport. I have written out a resolution which expresses the thought that I had in mind, and I offer it as carrying out the recommendation of the executive committee and as a substitute for the resolution of President Atherton. It reads:

> In view of the fact that this association has indorsed a number of plans looking to appropriations from Congress, and is likely to indorse others of similar character; Therefore be it

Resolved, That its executive committee be instructed to safeguard the interests of all these measures at every point, but to concentrate its efforts at any particular session upon the bill or bills which may seem to be in the most favorable condition for passage.

The resolution was adopted, and, after some further discussion, the resolution of President Atherton, as amended by the executive committee, was laid on the table.

G. T. Winston offered the following resolution and asked its immediate consideration, which was agreed to by the executive committee:

Resolved, That the executive committee be instructed to secure, if possible, such changes in the Mondell bill as will apply the funds appropriated thereby according to the previous policy of Congress in establishing and developing colleges for industrial education, such policy being outlined in the Morrill bill, the supplemental Morrill bill and the Hatch Act.

President Winston said, in support of the resolution:

The purpose of this resolution is that, if the committee can do it, they should get us back again the Mondell bill as originally introduced in Congress. It was then acceptable to the Association of Mining Schools and this association, and it was acceptable to everybody except the State universities. My motion is simply that we ask a continuance of the policy of the National Government as outlined in the three bills I have mentioned—the Morrill bill, the supplemental Morrill bill and the Hatch Act. We have those three laws already passed by the National Government, and my motion is that we ask Congress not to change the policy established by them. It is nothing new I am asking for; I am resisting something new, and something which will be the entering wedge in controlling any future appropriations that the National Government may make.

At the suggestion of President Thompson, President Winston amended his resolution to read as follows:

Resolved, That the executive committee be instructed to request Congress to continue the policy that it has adopted in the Morrill bill, the supplemental Morrill bill, and the Hatch Act, according to the lines there laid down.

The question upon the motion as amended was taken, and the motion was agreed to.

CLAIMS OF THE EXPERIMENT STATIONS TO THE CONSIDERATION OF CONGRESS.

H. C. WHITE. The second recommendation of the executive committee is:

It is recommended that the association instruct the executive committee to take appropriate action to secure, if practicable, the presentation of the claims of the experiment stations to the proper support and consideration of Congress at the next session of that body.

This recommendation of the executive committee was adopted.

STANDING COMMITTEES.

H. C. WHITE. The third and last recommendation of the executive committee is in regard to the matter of the standing committees of the association. The executive committee offers the following resolution and recommendations:

Resolved, That all matters affecting the relations of the association to the Government departments and to National legislation be assigned to the executive committee or to special committees raised from time to time to meet special exigencies, and that matters relating to the work of the association itself be assigned to the standing committees of the association.

It is recommended (1) that the standing committees of the association be as follows:

(a) On bibliography.
(b) On methods of teaching in the land-grant colleges.

(c) On graduate study.
(d) On extension work.
(e) On experiment station organization and policy.

(2) That each committee shall consist of five members.

(3) That the committees shall be appointed and announced by the president of the association at the concluding session of each annual convention.

(4) That the members of the committees, when practicable and unless the president for good cause shall otherwise determine, shall be selected from those in attendance upon the convention at which the committees were appointed.

(5) That vacancies arising between conventions shall be filled by the committee in which the vacancy has occurred.

After considerable discussion the resolution offered by the committee was adopted, and their recommendations were referred to a special committee consisting of A. C. True, L. H. Bailey, E. A. Bryan, W. E. Stone, and C. D. Woods to report during the convention. (For report of this committee see p. 50.)

DEPARTMENT OF AGRICULTURAL EDUCATION IN THE NATIONAL EDUCATIONAL ASSOCIATION.

The chairman of the executive committee reported the following resolution, offered by K. L. Butterfield, of Rhode Island:

Whereas this association believes that the questions involved in the general and the technical education of the rural people are of sufficient importance to warrant special recognition in the great gatherings of American educators: Therefore be it

Resolved, That our executive committee be hereby instructed to take such steps as they may consider necessary in an endeavor to secure the consent of the National Educational Association to add to its list of special departments a department or departments on rural and agricultural education.

K. L. BUTTERFIELD. I do not know that this resolution needs any extended explanation. It has been presented here after consultation with members who are in touch with the National Educational Association. It seems to me that while the suggestion might come from that association that it has already, perhaps, a sufficient or too great number of departments, the fact remains that the National Educational Association has not yet recognized agricultural education in a sufficient degree. It is true that the subject of rural schools has been taken up in the last eight or ten years, and well discussed by that association. It is also true that the recent report of the committee on industrial education is a good piece of work; but the department that we stand for has not been, to my mind, definitely and sufficiently recognized by the National Educational Association. It happens that the National Educational Association has announced that it is to ask for a bill of incorporation from the next Congress, and in that bill there are specified seventeen departments already existing.

Now, it seems to me that the work of agricultural education has attained sufficient dignity to demand from the body of our educators a department. It is true that these things may be taken up in a general session, but, as a matter of fact, they will not be sufficiently discussed. It also remains true that if we had a department of this sort, we, who are members of this association, would be charged with the responsibility of supporting it; but it seems to me that would be wholly a good thing, that we ought to be in closer touch than we are with that association, and they ought to recognize more fully the relations of our special lines of work to the general educational movement of the day. And this matter leaves the method entirely with our executive committee, to treat it as they see fit, to call it what they see fit, and, in fact, to engage as they see fit with the National Educational Association.

On motion the resolution offered by President Butterfield was adopted.

Hon. William T. Harris, Commissioner of Education, being introduced, spoke as follows:

ADDRESS OF HON. WILLIAM T. HARRIS, COMMISSIONER OF EDUCATION.

Gentlemen, I thank you for this indication that you like to hear or see me for a moment and hear a word from me, and I would like to put in that word right here on the subject that has now been brought up before you. The National Educational Association has one large general meeting, as you do, and it has ever so many departments and may have ever so many more. Anyone who is interested in any line of education in one of these departments may, if he can get together twenty or thirty or forty or fifty persons who wish to pursue his special line of investigation, have a department formed for them, and the general executive committee of the association, in going from one city to another year by year, make arrangements for them and take care of all the business part of it, so that all that these particular specialists who form a new group need to do is to meet at that room which is provided for them on the dates specified. I think, myself, it is really most important that agriculture—that is, agricultural instruction—in the elementary schools, and perhaps also in the secondary schools, should be provided for in the National Educational Association, and if President Butterfield should be charged with that matter and bring it before the association it would be very easy to get such a department established, and the movement would prove fruitful to the National Educational Association itself, because it would get hold of and meet a certain desire and impulse that is moving throughout the country to have agriculture recognized. I suppose there are various crude attempts all over the country to introduce instruction in agriculture. Sometimes that movement stops at the vestibule. When you and I, Mr. Chairman, were little boys agricultural instruction in this country began at the vestibule, and began by teaching a little book chemistry and a little Latin, and things of that kind, and never got beyond that. Of course the great point now in our day is that we push beyond the vestibule, and sometimes we push so far that we forget that there is any vestibule and that there ought to be one. Now is the time when there ought to be a department devoted to agriculture in the National Educational Association. The National Educational Association collects at its meetings from 20,00 to 35,000 people sometimes. We had one meeting attended by 36,000 people in Boston last year; a very large gathering, and a great market fair, as it were, of education of all kinds.

Once I was interested in getting up a series of round-table discussions; it is amusing to think of it, and perhaps some of you here may remember the result of it. We had discussions at Saratoga, and we had them on such transcendental subjects as Schopenhauer and his pupils in Germany and their pessimistic discussions. You could have such discussions in round tables, but not on the farm.

But agriculture should be brought up every year at the educational association and a harvest of the thoughts be gathered there. That was the object of establishing this great market fair of the National Educational Association—that each one should bring his contribution to it, and find other persons who had been working along those lines; and each one taking what is brought by the others, each goes home richer by many things than the one thing that he brought. That is what will happen in the National Educational Association if this section is formed. There will be a gathering together of results and a reaping of them, and it will give the agricultural colleges all over the country and the State universities which deal with agriculture a part and place. Every university, of course, every year finds certain lines on which it wishes it could influence the elementary schools, and each one examines the educational instruction in the elementary schools to find something that might be adopted in his own State. There are thousands and thousands, sometimes as many as a hundred thousand programmes of the annual meeting of the association circulated all over the country before the meeting. But I need not tell you about the National Educational Association, except that it has $150,000 at interest, income to be appropriated to printing its proceedings, so that a good paper on any subject always gets printed, and it is possible to get these papers reprinted sometimes, as the matter is electrotyped.

STATISTICAL WORK OF THE U. S. DEPARTMENT OF AGRICULTURE.

H. C. WHITE, of Georgia. The executive committee reports the resolution offered by Director Waters, of Missouri (p. 29), and recommends its passage in the following amended form:

Whereas the collection and publication of accurate agricultural statistics is of importance and of great assistance to the land-grant colleges in connection with the teaching of agricultural economics: Therefore, be it

Resolved, That it is the sense of the American Association of Agricultural Colleges and Experiment Stations that the United States Department of Agriculture should continue the collection and dissemination of information and statistics with respect to the condition and yield of farm crops.

The resolution was adopted as amended.

REPORT OF COMMITTEE ON COLLEGE AND STATION EXHIBIT AT THE ST. LOUIS EXPOSITION.

W. H. JORDAN, of New York. Your committee wishes to present you with a document which covers the history of the life of that committee, and to call to your attention the fact that the initiative of the effort to secure the exhibit at St. Louis began four years ago, so that the work of your committee covers four years from the initiation of the effort to the final act. Our object in having this report prepared (and we owe many thanks to the Office of Experiment Stations for the real labor of the preparation of the report), covering, as it does, a complete history of what the committee did, is to put it on file, so that it may be available to those who have any such burden in the future, a complete record of what was done at the St. Louis Exposition, and what steps and machinery were used that would pertain to similar efforts.

I only wish to make one or two remarks on this. In the first place, we did not spend all our money. The main reason for expending only about $90,000 out of the $100,000 that we had was that we were unable to inaugurate, on so extensive a basis as we desired, what was known as the " outside exhibit."

A. C. TRUE. I take it that the acceptance of this report will hardly include the ordinary understanding that it is to be made a part of the proceedings of this meeting. We have to deal with the printing of these in the Department of Agriculture, and it is, therefore, of interest to me. I would suggest that it be received with the understanding that it is to be placed on file in the Office of Experiment Stations, where it will be available to all future committees who have to deal with such matters. I have considerable doubt whether, as Director of the Office of Experiment Stations, I could recommend the publication of the report in its present form. There are many details in it which would be of very little use except to a committee dealing with the matter. There is absolutely no provision in law for the printing by the Government of any report of the St. Louis Exposition. The only thing that the Government Board has undertaken, as I understand it, is the preparation of a catalogue, more or less extensive, of the exhibit as a whole. If that is to be printed at all it will have to be by special act of Congress. In the case of the Chicago exhibit, if I remember correctly, no report was ever printed by the Government. In the cases of some of the foreign expositions quite extensive reports have been printed. I might say that a somewhat extended report of this exhibit, with illustrations, has been published by the Office of Experiment Stations in its report for the year 1904, and, as far as I am aware, that covers everything that the association desires to have that can be gotten out of this report.

JAMES K. PATTERSON, of Kentucky. That report, I have no doubt, contains a great deal of valuable matter. I doubt whether any appreciable part of the contents is known to any member of this association outside of the committee of the association that had charge of it. I doubt whether one-tenth of it is known to the members who had charge of it. From that point of view, it seems to me publicity should be given to it. It seems to me that was a very important exhibit. It was not only agricultural, but also mechanical, and I have no doubt there are hundreds and hundreds of persons throughout the country who would read that report with interest. I believe that every member of the association into whose hands it might come would read it and would profit by it. It seems to me that a proper appeal made to the National Congress by the executive committee of this body, or by any other properly constituted committee representing this body, would obtain recognition from that body and enable us to give it to the world.

A motion that the report be received and placed on file in the office of Experiment Stations was agreed to.

On motion of W. D. Gibbs, of New Hampshire, a vote of thanks was extended to the committee whose duty it was to arrange the exhibit at St. Louis.

RESOLUTION REGARDING NATIONAL GRANGE.

William P. Brooks, of Massachusetts, offered a resolution, as follows:

Resolved, That the Association of American Agricultural Colleges and Experiment Stations extends to the National Grange of the Patrons of Husbandry assembling to-day at Atlantic City, N. J., its cordial greetings and best wishes for a gathering which shall be fruitful in good work.

The resolution was adopted, and the secretary was instructed to transmit it to the meeting of the National Grange by telegraph.

Thereupon the convention adjourned until 8.30 o'clock p. m.

EVENING SESSION, WEDNESDAY, NOVEMBER 15, 1905.

STANDING COMMITTEES.

A. C. True, of Washington, D. C., presented the report of the special committee on standing committees, as follows:

The special committee on standing committees submits the following recommendations:

(1) That the standing committees of the association be as follows:
  (*a*) On instruction in agriculture.
  (*b*) On graduate study.
  (*c*) On extension work.
  (*d*) On experiment-station organization and policy.

(2) That each committee shall consist of six members. When the committee is first appointed two members shall be appointed for one year, two members for two years, and two members for three years. Members appointed therafter shall serve for three years, except that members appointed to fill vacancies shall serve only during the unexpired remainder of the terms of the members whose places they take.

(3) That the committee shall be appointed and announced by the president of the association at the concluding session of each annual convention.

(4) That the members of the committees, when practicable and unless the president for good cause shall otherwise determine, shall be selected from those in attendance upon the convention at which the appointments are made.

(5) That vacancies arising between conventions shall be filled by the committee in which the vacancy occurs.

For the committee:

A. C. TRUE, *Chairman.*

A. C. TRUE. This report follows quite closely the recommendations of the executive committee with regard to this matter, the only changes being that the committee on bibliography is dropped, as I understand was agreed upon this forenoon by the association. The committee on instruction in agriculture is substituted for the one on teaching in land-grant colleges. This is done with the idea that this committee on instruction in agriculture will consider in a broad way the courses of instruction in agricultural colleges and schools preparatory thereto, and in that way will take in probably all the subjects which, under present conditions, are likely to be considered by the committee.

The work of the committee on extension work would then relate to such matters as farmers' institutes, correspondence courses, clubs of boys and girls, and other matters ordinarily included in such work.

Another change made is in the extension of the number of members in each committee from five to six. This was done in order to make it somewhat easier to subdivide the committees into subcommittees for special purposes, and also to make possible the other provision inserted, that these members be divided into classes, so that two new members might be appointed each year, and the older members would hold over, making the term of service, in all, three years.

The third and fourth provisions are identical with those of the executive committee, and the fifth is also the same, and in any case is hardly necessary, perhaps, because it follows the standing rule of order of the association.

The report was adopted.

RESOLUTION REGARDING PROF. W. O. ATWATER.

C. D. WOODS, of Maine. Those of us who have been familiar with this association from its earlier days remember how much we owe to the interest in the first meetings, and the later meetings, as well, of Professor Atwater, who was the first director of an experiment station, and the first Director of the Office of Experiment Stations. As I presume it is known to most of those here, Professor Atwater was stricken more than a year ago, and is now lingering at his home in Middletown. With the consent of the executive committee I have drawn, and now present, a short note of sympathy which I would like to present at this time, the executive committee favoring its adoption, and to ask that the secretary be instructed to report it to Mrs. Atwater:

> The Association of American Agricultural Colleges and Experiment Stations regrets that illness prevents Professor Atwater from being present at this meeting, and as he was the first director of an American agricultural experiment station, and the first Director of the Office of Experiment Stations, and as in other ways he has done much for the work, and will always be remembered, the association extends its sympathy, and all wish that he may soon be much improved in health.

The resolution was adopted, and the secretary was directed to transmit the same to Mrs. Atwater.

OFFICERS OF SECTIONS AND MEMBERS OF EXECUTIVE COMMITTEE.

K. L. Butterfield, of Rhode Island, reported that the college section presented for members of the executive committee H. C. White, of Georgia; J. L. Snyder, of Michigan; and L. H. Bailey, of New York; for chairman of section, C. R. Van Hise, of Wisconsin; for secretary of section, H. C. Price, of Ohio; for programme committee, the chairman and secretary of the section.

The report was accepted.

M. A. Scovell, of Kentucky, for the experiment station section, reported as follows: For chairman of section, B. C. Buffum, of Wyoming; for secretary of section, M. A. Scovell, of Kentucky; for members of the executive committee, W. H. Jordan, of New York, and C. F. Curtiss, of Iowa; for programme committee, H. P. Armsby, of Pennsylvania; C. F. Curtiss, of Iowa; M. A. Scovell, of Kentucky.

The report was accepted.

ANIMAL AND PLANT BREEDING—THE AMERICAN BREEDERS' ASSOCIATION.

C. F. Curtiss, of Iowa, presented the report of the committee on animal and plant breeding, as follows:

Your committee on the American Breeders' Association submits the following report:

The American Breeders' Association held its first annual meeting at Champaign, Ill., February 1-3, 1905, as the guest of the Agricultural College of the University of Illinois and of various State live stock and agricultural associations. The meeting was well attended, great interest was taken in all sessions, and a splendid three days' programme was carried out.

The council has recently issued the first annual report, including, with the papers and discussions, a classified directory of members, showing the lines of scientific interest with which each member is concerned and the lines of pure-bred live stock and pure-bred seeds produced. There are now about 600 members, and the association is without debt.

There is need of a fund to place the association on a permanent basis. The members of the Association of Agricultural Colleges and Experiment Stations and others interested are urged to aid in their respective States in increasing the membership and in other ways to help build up this organization. Persons who have wealth to devote to public uses could serve a most important public purpose by providing a suitable endowment for this promising association.

The second annual meeting has been called to meet at Lincoln, Nebr., as the guest of the College of Agriculture of the University of Nebraska and of the several State societies of live stock, agriculture, and horticulture during "agriculture week." It is expected that the association at its second annual meeting will appropriately recognize the good offices of the parent association.

The work of this committee having been accomplished, we recommend that it be discontinued.

Respectfully submitted.

W. M. HAYS,
L. H. BAILEY,
C. F. CURTISS,
Committee.

The report was adopted.

COOPERATION BETWEEN THE STATIONS AND THE U. S. DEPARTMENT OF AGRICULTURE.

E. A. BRYAN, of Washington. In behalf of the committee on cooperative work between the experiment stations and the United States Department of Agriculture, I would say that all matters of concern in connection with cooperation have become of such importance that it seemed desirable and necessary that the executive committee of this association should take immediate cognizance of that work, and they have, during the past year, had that matter entirely in charge and have already made a report to this association in regard to the cooperative work, so that any further report on behalf of the committee seems to be entirely unnecessary.

MEETING PLACE OF NEXT CONVENTION.

E. Mead, of the U. S. Department of Agriculture,[a] presented a large number of cordial invitations from California to hold the next convention of the association in that State.

Cordial appreciation of the invitations and of the hospitality extended on the previous visit to the State was generally expressed and a resolution offered by

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[a] Representing the California Experiment Station.

J. K. Patterson was adopted, expressing the sense of the meeting that the invitations should be accepted if it seems feasible to do so.

The convention adjourned at 10 o'clock p. m., to meet November 16, 1905, at 9 o'clock a. m.

MORNING SESSION, THURSDAY, NOVEMBER 16, 1905.

The convention was called to order at 9 o'clock a. m. by the president.

FORESTRY IN LAND-GRANT INSTITUTIONS.

The chairman of the executive committee reported back to the association the series of preambles and resolutions, by S. B. Green, of Minnesota, already given in full on page 27, with the recommendation that they be adopted in the following form:

Whereas the forests of this country are fast disappearing and little or no attention is being paid to their renewal; and

Whereas the development of this country is seriously threatened by a shortage in timber supply: Therefore be it

Resolved by the Association of American Agricultural Colleges and Experiment Stations in convention assembled, That the national forestry policy of this country should include provision for education and experimentation in forestry by the agricultural colleges and experiment stations of the different States and Territories.

S. B. GREEN. Our forest resources seemed at one time to be inexhaustible. It seemed as though we had such a wealth of forest that we could never use it up. But we are fast getting to the point when it is a question where we shall get the valuable timbers and woods to use in our industries. The increase of stumpage value has been enormous in the past ten years. We have been working our timber resources just as we would a mine. We have not treated them as though they could reproduce themselves, and the land that has been cut over is practically nonproductive to-day. It is brush land, burned over every few years, and on which the new growth is of little value. There is a shortage of timber, and timber is the foundation of many of our industries.

There is an immense amount of mining riches in the United States that ought to be developed, but it is probable that there is hardly a mine made which does not have to be heavily timbered; and there are no heavier consumers of timber than our mines. And in many sections of the country to-day they have difficulty in finding timbers for properly timbering their mines.

I know of one mine in Minnesota that uses something like 80 miles of log timber in a year. We have an enormous amount of waste land that is unproductive, not only in Minnesota, where we have many millions of acres of that kind, but throughout the United States. There is not a State in this country that has not an enormous amount of land that is nonproductive and could be made productive, if properly cared for, in forests.

Without forests we are going to be handicapped in the development of this country. We have been working a primeval source of timber supply. Somebody may say that the forests of Oregon are inexhaustible, or those of the Pacific slope; but they are not. It should be remembered also that more timber has been destroyed by fire in this country than was ever cut by the lumbermen, and the cause of the fires lies in the lack of realization as to the amount of damage that is done by it. There is not a State which does not need forest instruction. There are some States where the people are very apathetic in regard to this matter.

The National Government is doing a grand work through its Forest Service in the spreading of correct ideas as to forestry throughout this country, and its management of the forest-reserve business has been such as to be very gratifying to the American people; and yet we need to have, in order to carry that work out to its fullness, a better, a higher intelligence among the people as to the possibilities of forestry—as to what it is reasonable to expect from forests. How can we spread that information, is the question. It seems to me that that could be best undertaken by the land-grant college.

It seems to me that these land-grant colleges are especially fitted for this work. Forestry is an agricultural subject, and the subjects which are generally taught in our agricultural colleges bear with directness upon forestry, and forestry could be added to these courses very easily. My idea is this, that we ought to look upon this matter of instruction in forestry in our agricultural colleges as a part of the national policy of spreading correct information in regard to forestry through this country. Some one may raise the argument that iron and concrete and cement are largely replacing wood in construction. That is true to a large extent, and yet, in spite of all that, the per capita consumption of wood has increased since the substitution of these other materials for wood has come into vogue.

GIFFORD PINCHOT, of the Forest Service. Mr. Chairman and gentlemen, I am particularly glad to have a chance to say a word on this matter, because I feel very strongly, indeed, the desirability of the work that Professor Green has laid before you. I think we may fairly divide instruction in forestry into two perfectly separate and clear-cut parts, just exactly as we may divide instruction in almost any other professional subject in the same way. On the one hand is that instruction which is intended to make professionals who will practice law or medicine or forestry, or whatever it may be—giving their whole lives to it; and on the other side is the instruction upon which the general intelligence of the country is based, the instruction that a man needs who is going to give his life to something else; and as I understand Professor Green, it is the second of these two lines of instruction that he is advocating. I have gotten from Doctor True a statement of instruction in forestry in the land-grant colleges, and the figures show that 33 of the colleges are at present engaged in giving such instruction, two or three of them preparing men for professional work, the others teaching what may be called "agricultural forestry." Now, we are not going to find it possible at any time, I think, to bring trained men in contact with the farmer's wood lot unless in the future we should change our ideas of the Government entirely and begin State supervision of the lumber business. The handling of the wood lot by the farmer is going to control forestry over areas which are astonishingly large. For instance, there are now at least twice as many acres in wood lots in farms as there are in national reserves. And if a man who owns it can understand how to handle it, or, if he does not, can employ a professional forester to come and show him how, there is an enormous gain; and, on the other hand, if the men who pass through the land-grant colleges who are not going to make forestry a profession can have the same knowledge as a student in a business college has about law, which does not fit him to be a lawyer but is of the very greatest service to him in his work, then I think a very great service has been rendered. I see no reason whatever, if things go on as they are going now, why we should not have better intelligence among the masses of our people about forestry than any other country in the world. I think our people now understand what forestry means better than any other nation. Forestry is a live topic here, and it has never been more live and more prominent in the minds of the people than it is just now. All of that means to me that this is a most desirable thing to do, and I want to back it up just so far as I am able to. I would not want to back it up—and I want to make that perfectly clear, and I should be compelled to back the other view—if this meant that a lot of men, half educated in forestry, were going to be turned loose on the country as trained foresters. That would be the most serious setback that our forest work could have, and any influence that might be brought to bear against it would be a good thing to be brought to bear. That would put us in the same position that the medical profession would be put in if a lot of people could be turned out as regular doctors who had had only six months' or a year's training. The profession of forestry and the training for it is an entirely different thing from this most desirable spread of general information about forest topics.

Now, it is quite possible—and I should like to make the offer very heartily—if this matter goes through the Forest Service can be of use to the different land-grant colleges and to the experiment stations in giving advice when called upon, and, perhaps, in recommending men or furnishing publications, or in any other similar way. And I want to say that we should be only too glad if in any of these directions we can be of use to you if this matter goes through. I feel very strongly indeed about it, because we have been taking this up, and our attention has been called to it in the Forest Service in the last two or three years, that the most desirable thing that could happen to the Forest Service in this country would be to make the general rough outlines of it generally known, and, as Professor Green has very well said, the solution of this question is in the minds of the people.

C. A. KEFFER, of Tennessee. It seems to me that the matter of forestry education in the land-grant colleges has about the same relation to technical forestry education as has the general course which a college gives to a special course in medicine. In many and, in fact, most of the colleges students who have taken the biological-science course are given credit for it when they come to take their special courses in medicine, and there is a gain to all the people wherever the preliminary course in forestry is offered to students at home before they shall undertake the technical courses of the larger profession, the technical courses that they must have in order to go into the business as foresters. There is a gain, then, from the student's point of view and there is economy from the student's point of view in offering in the land-grant colleges lines of work that shall lead and shall prepare for the more technical course that the forestry schools offer. I can see no advantage in multiplying technical forestry schools. The country has now a Forest Service. These courses would appeal to the students, and we should inevitably prepare men in advance of the demands of the country, and it seems to me that this would be a misfortune. Aside from that, relief would be given to those professors who are attempting to teach forestry in the land-grant colleges in addition to their regular work. In Tennessee, and I think generally in land-grant colleges, instruction is given by the horticulturist or the botanist, whose duties in his original line would seem to require all his time. There is, then, need of relief in this way in this direction, and there is no doubt that instruction offered by experts should be just as valuable in this line as in any other line of scientific research. I myself have found that there is hardly a more interesting subject for the student than forestry. It is a line of work that has two phases. There is the biological phase, which so many enjoy, and then there is that larger application of the trend of a great principle in general mechanics which is yet to be developed, and it seems to me, as one factor in the resources of the country, we have in forestry one of the subjects that ought to have a large place in the work of the land-grant institutions. If these land-grant institutions came closer into the lives of the people this would help us in developing the national resources. With forestry there is quite as much need of conservation as of development. We have reached a point where the business of lumbering is probably as thoroughly developed as any in the United States, but we have not reached a place where the business is taking care of the resources on which the business is based. It would seem that the source of this business is being dissipated. We all know that the business of lumbering is gone from the North. In Tennessee, indeed in all the Southern States, there is need of careful study of the hard woods of the country. In the Central South there is, as you all know, the greatest hard-wood forest of the country, and yet I suspect the forester is not as fully advised as he should be as to the best means of handling this important forest. From the point of view of the forester, and from the larger point of view of those interested in the conservation of the national resources, it seems to me that anything that can be done in the direction of instruction in forestry ought to be commended by this association.

The resolution as amended was adopted.

ELECTION OF GENERAL OFFICERS.

H. P. Armsby, of Pennsylvania, presented the name of M. H. Buckham, of Vermont, for president of the association. J. K. Patterson seconded the nomination. The secretary of the association was instructed to cast a unanimous vote for President Buckham. In like manner C. C. Thach, of Alabama, was nominated and elected first vice-president; E. H. Jenkins, of Connecticut, second vice-president; J. H. Worst, of North Dakota, third vice-president; B. I. Wheeler, of California, fourth vice-president; and L. Foster, of New Mexico, fifth vice-president; J. L. Hills, of Vermont, secretary-treasurer; and A. C. True, of the Office of Experiment Stations, bibliographer.

WORK OF THE OFFICE OF EXPERIMENT STATIONS IN AGRICULTURAL EDUCATION.

T. F. Hunt, of New York, introduced the following resolution:

Resolved, That this association recognizes the great value of the work of the Office of Experiment Stations in promoting the cause of agricultural education in the United States, and heartily indorses the action of the Secretary of Agriculture in encouraging and aiding the efforts of the Office in this direction.

The executive committee recommended immediate consideration, and the resolution was adopted.

VOTE OF THANKS TO REPRESENTATIVES ADAMS AND MONDELL.

J. L. Snyder, of Michigan, offered the following resolution:

Resolved, That a vote of thanks be extended to Representative Adams for his efforts in behalf of securing increased appropriations for the experiment stations of the United States.

The executive committee recommended immediate consideration, and the resolution was adopted.

J. K. PATTERSON. I think we ought to couple the name of Representative Mondell with that of Representative Adams in the vote of thanks and confidence that has just been given expression to in behalf of Mr. Adams. We are all interested in that measure, some of us more and some less, but we are also interested in the passage of a bill that will add to the existing endowments of agricultural and mechanical colleges in the special direction of schools of mines and mining and engineering. I believe there is a possibility of passing this or some kindred measure, and Representative Mondell has been committed to its advocacy hitherto, and it seems to me it would be a fitting tribute to what he has already done, and it would be an encouraging stimulus to further effort to couple his name with that of Mr. Adams in the resolution just passed. I therefore move that a similar vote of confidence and thanks be accorded to Representative Mondell, and that the secretary be directed to transmit the resolution to him.

The executive committee recommended immediate consideration, and the motion was unanimously agreed to.

ANNUAL DUES.

The secretary moved that the annual dues for each college and station be fixed at the usual sum, $15, for the ensuing year, and the motion was agreed to.

FEDERAL AID IN CONTROL AND EXTERMINATION OF THE GYPSY MOTH.

H. J. Wheeler, of Rhode Island, offered the following resolution:

Whereas the gypsy moth has already gained a foothold in three States in the Union; and

Whereas it has as yet no effective parasite enemies in the United States and is in consequence a menace to the agriculture and forestry of the entire country: Therefore be it

Resolved, That this association is of the opinion that the time has come when the Federal Government should lend its aid in the control and extermination of this pest.

The executive committee recommended immediate consideration, and the resolution was adopted.

MEMORIAL TO PRESIDENT H. H. GOODELL.

President W. E. Stone, of Indiana, delivered the following memorial address upon the life and services of President Henry Hill Goodell:

Since the organization of this association few of its gatherings have been without the conspicuous and efficient participation of one whose absence from the last annual meeting was so notable and the occasion of so much comment. At that time the thought would scarcely have occurred, even to his intimate friends, that the long and honorable service of President Goodell to the American agricultural colleges and experiment stations had been completed.

In the interval since that meeting his name has been written on the long roll of the dead, and the association meets to-day in special session to express its respect for his memory and appreciation of his work.

To some of my hearers no word of mine can convey a better knowledge of the worth and work of our late associate than they already possess from their personal acquaintance and collaboration with him. But there are many other members of this association who from the nature of things must have an imperfect knowledge of the services of President Goodell and his contemporaries in the early stages of its history.

A review of his life and work may therefore have a twofold result: It will enable us all to rightly value his high worth, and it should impress upon us the significance of the work of this association in the past, the importance of the policies that have been pursued, and the inestimable value of the services of those men who have been leaders in the inception and early work of the association.

During all of his active life President Goodell toiled unceasingly in that work of the establishment and advancement of agricultural education which has been the principal educational event in America in the last half century; yet, strange to say, he was not by birth, tradition, or training connected with agriculture in any way. Born of missionary parents in a foreign land, and educated in a typical New England college of liberal arts, one could scarcely have predicted for him such a career as he followed. But a coincidence of events brought him, youthful, ardent, and resolute, face to face with the beginnings of two historic epochs worthy of his entire devotion—the civil war and the establishment of the great Federal system of industrial and technological education. His character possessed traits which made it impossible for him not to engage in these great movements. It was not prevision, for his nature never asked hostages of the future; but it was a call of immediate duty, a sense of important work to be performed which led him first to the service of his country, and, after a brilliant career in the field, to enlistment in the first faculty of one of the first colleges to be established under the Morrill Act, where he labored continuously and conspicuously until his death.

Henry Hill Goodell, son of the Rev. William and Abigail Goodell, was born in Constantinople, Turkey, May 20, 1839. He prepared for college at Williston Seminary, Easthampton, Mass., and graduated from Amherst College in 1862. He was commissioned second lieutenant Company F, Twenty-fifth Connecticut Volunteers, August 16, 1862, first lieutenant, April 14, 1863, and was appointed aid-de-camp on the staff of Colonel Bissell, of the Nineteenth Army Corps, July 8. He participated in the engagements in Louisiana of Irish Bend and Vermillion Bayou, in the siege of Port Hudson, and in the Teche campaign, and was mustered out of the service August 26, 1863.

From 1864 to 1867 he was an instructor in Williston Seminary, and at the opening of the Massachusetts Agricultural College in 1867 was appointed professor of modern languages and English literature. In 1886 he was elected president of the college; in 1887 director of the experiment station, filling both these offices until his death. He was an original member and one of the founders of the Association of Agricultural Colleges and Experiment Stations, president of the association in 1891, member of the executive committee from 1888 to 1902, and chairman of the same from 1894 to 1902. In the spring of 1905 he went to Florida to recuperate from an acute illness, and, being homeward bound, died on shipboard in Boston Harbor, en route from Savannah to Boston, April 25, 1905.

I pass rapidly these milestones of his career to dwell upon certain traits and achievements which will give us a true picture of the man. During forty-one years he was a teacher, and thirty-eight of these years were given to one institution. But if we think of him as a plodding college professor, performing only his routine tasks during all of this time, we shall do him injustice. His character was a rare mixture of energy and enthusiasm, with patience and enduring persistence, of breadth of view and love of detail. He was capable of the utmost self-forgetfulness in rising to the demands of an emergency. He was also able to toil indefinitely at an obscure task which he believed worth doing. He possessed and retained an optimistic and enthusiastic courage characteristic of youth, but with him an inborn trait. He was not self-conceited or self-confident, but he was self-reliant, and when he faced any issue with cheerful and hopeful trust in the outcome, as he always did, it was simply an expression of this side of his character—of his faith in the ultimate triumph of right. Those who knew him well had no need to call upon their imaginations to picture him in the midst of a desperate hand-to-hand struggle in the assault on Port Hudson, acquitting himself with signal bravery, nor to see him, after this assault had twice failed, the first man to respond to a call for volunteers to lead a forlorn hope. He had all of the martial spirit and abandon to become the foremost figure at such a time, but without boastfulness or swagger, and he had also the greater courage to face the repulses and obstacles of life modestly, but unyieldingly.

More than twenty years ago he stood face to face with an insidious and fatal disease, the assaults of which might well have made the stoutest heart sink. But few of his friends knew of it. None ever heard him complain. By sheer determination he repulsed the attack and held the foe at bay for years. The last years of his life were a constant struggle with disease, but few would have guessed the fact, nor would he swerve from the conscientious performance of his duties on this account. Some men possess a courage which is inspired by excitement. Others have that quiet courage which is firm under the most depressing conditions. President Goodell's courage was a part of himself—dominant and ever present. In the hours of deepest trial he was not cast down. No danger was great enough nor any misfortune so threatening as to drive from his face a cheery smile or from his lips a kindly greeting.

But this energy and courage were mingled with a genial and sympathetic disposition and were tempered with wisdom. These qualities inspired love and confidence on the part of his associates. In the army his comrades voluntarily placed their pay in his hands and sent him on a long and dangerous journey to bring this large sum to a place of safety. Later he was trustee of the relief fund of his Grand Army post. His fellow-citizens trusted him also, and he was identified in a helpful way with all good movements and enterprises in the town of Amherst, where he lived.

The excellent public library there exists as a monument to his efforts, and it gives us insight into his industry and energy to know that for many years he gave his time to the details of the work, so that, it is said, more than 7,000 entries in the card catalogue are in his handwriting. In a like manner he was vestryman, delegate, and committeeman in his church and clerk of the same for twenty-five years. He was president of the Amherst Club, representative to the legislature, member of the Massachusetts Horticultural Society and of the Massachusetts Agricultural Society.

These were all matters incidental to his real life work, but his interest in and devotion to them were characteristic of the quiet, service-seeking side of his nature, which at times could also rise to heights of enthusiastic action.

To the Massachusetts Agricultural College he devoted his life, beginning when a young man of 28, from which time until his death, a period of thirty-eight years, he gave unsparingly all that he had in any service which could be of value to that institution. He was appointed to instruct in literature and modern languages, but, with a fine spirit of devotion, he did not think it beneath his dignity, as the necessities of the college demanded, to serve at different times as instructor in gymnastics and military tactics, as lecturer in entomology, as instructor in anatomy and physiology, and as instructor in rhetoric and elocution. He was also for a time secretary of the faculty, for fourteen years librarian, for some months acting president, and, finally, for nineteen years president. He rendered this variety of service not because of any restlessness or special versatility, but strictly from a sense of duty to the college, which in its early days was often compelled to utilize all of its resources in order to fulfill its obligations to students. As one contemplates this record of service he is struck by the devotion, the capacity for application exhibited by President Goodell, and the amount of work which he actually turned off. For instance, he was a passionate lover of books, and early took upon himself to care for the college library. For many years, in addition to his other duties, he was librarian in fact as well as in name, selecting and purchasing books, keeping records, preparing the card catalogue, arranging exchanges—all with marvelous efficiency—and thus created by his own personal efforts one of the most complete and well-selected agricultural libraries in the country.

The college was for many years one of the pioneers in the field, located in a community in which agriculture was a minor industry, and surrounded by an educational atmosphere which was unsympathetic, if not hostile. The conditions were discouraging and incompatible to a young man of Goodell's training and temperament, but here again his quality of courage, based on confidence in the right of things, kept him faithfully at his post, and he lived to see the day when, largely through his own efforts, the college had established itself in the esteem of the community, overcome prejudices, and secured a high educational standing. Through all of this evolution he adhered persistently to high standards of education, such as seemed to him befitting the institution and the intellectual conditions of the State.

When he became president of the institution it stood sadly in need both of students and resources. The problems before him were difficult, involving, first of all, the establishment of public confidence in the college. His labors in this direction were forceful and effective, and he soon succeeded in securing needed recognition from the State. During his presidency the real estate of the college increased in value one-third; its equipment, fourfold, and its income, threefold.

His relations with students were firm but kindly; severe in discipline, but only as a last resort, and withal with such sympathy and kindliness of heart that few others of the long-time members of the faculty were so well beloved as he. He kept up a large correspondence with alumni and old students, resulting in an exceptionally accurate record of all who had ever attended the institution. He remembered and could call by name most of those who had come under his care. With this record of quiet, unselfish, and effective devotion to the institution and its students, it is no wonder that his name is affectionately cherished and honored at the Massachusetts College.

In the work of this association, and in the establishment of the foundations of the land-grant colleges and experiment stations, President Goodell had an important and almost unique part. A full comprehension of this can only be had by those who shared with him these labors. With the passage of the Hatch Act it became apparent that an organization of the executive officers of these institutions was a necessity. The attention of Congress could only be secured by he presentation of matters of national scope in concrete and unified form. The plan of education and research mapped out for the land-grant colleges was too broad, varied and comprehensive, and too vital to permit of its development without organized direction. It was necessary on more than one occasion to urge upon Departments of the Government a consideration of conditions which led to fair and beneficial rulings with regard to these institutions. The questions of jurisdiction and of the relations between the separate institutions and governmental Departments were, and have ever been, of greatest importance. The heads of these colleges were pushing out into new and unexplored regions, and felt the need of mutual aid and advice. All of these considerations emphasized to Goodell and his colleagues the necessity of an association for mutual aid and protection, as well as for the general advancement of the interests to which these institutions were devoted. In the organization of this association he was a moving spirit, and in its subsequent work always an active participant. He was a member of the executive committee from 1888 to 1902, and during the last eight years of this time was chairman of the same. In this capacity he labored untiringly, not only in the broader duties of the position, but in multitudinous details which contributed to the success of the organization. One can recall distinctly his methods of preparing and presenting the business of the association in a complete and finished manner, which expedited the routine of its work, even at the cost of apparent officiousness on his part. His rare tact and insight into human nature; his broad outlook upon the field of agricultural education; his wide knowledge of public men, and thorough familiarity with the history of the land-grant college movement fitted him for the place of leader in the work of the executive committee and enabled him to render inestimable service. The attention of Congress and of governmental Departments has been favorably molded by the wisdom and firmness of this committee. The threatening danger to the Federal appropriation to the colleges and experiment stations through the gradual diversion of the proceeds of the sale of public lands was foreseen and averted through his efforts and leadership in securing protective legislation in 1900. His conservative and wise but energetic action averted many dangers and laid foundations which will sustain our institutions for a long time to come. That we have passed through this period of development so safely is due to a strong organization and able leaders, among whom Henry Hill Goodell stands conspicuous. To few, if any, of these do the agricultural colleges and experiment stations owe a greater debt than to him.

Such an example should long survive the life that gave it and long continue to inspire and guide the members of this association. In meeting new conditions and emergencies, we shall do well not to abandon those established principles which characterize our institutions; we should seek conservative rather than too liberal interpretations of the statutes, and we should be willing to intrust larger responsibilities and greater freedom of action to tried and wise leaders.

Thus far I have spoken of President Goodell's work and achievements, with little reference to his character. But no tribute to his memory may consistently omit the highest appreciation of his personal qualities. He did much, he served well, but he will be longest and best remembered for those traits which endeared him to all who knew him.

His was no common spirit. I should like to know more of his ancestry, to trace those fine and subtle threads which wove the texture of his character. All the substantial qualities of a man of honor were his—frankness, honesty, sincerity, courage, fidelity, and much more. He possessed a true nobility of soul, an instinctive gentility, a spirit of chivalry which eludes analysis but which made itself unceasingly felt. The very fitness and high quality of his traits caused him to be sometimes misunderstood. As a matter of fact, no man was more democratic; and although by some deemed aristocratic and distant, no man was more genuinely sympathetic. In truth, he had in him nothing vulgar or commonplace; his being repelled familiarity; his fibers were attuned to the sweet and true notes of life, but the coarse and gross affairs of men awoke in him no answering chord.

I have known no man who seemed to embody so much of the chivalrous spirit; that spirit which takes no advantage of an opponent, which yields to others, which sacrifices all for a friend, which is embodied in the untranslatable noblesse oblige. His generosity and self-restraint gave always to others the opportunity and took to himself the obscure and painstaking task.

He lived a full and rich life of service in a great cause, and left a record of permanent achievements, but the finest and best of his life was known only to his intimate friends and to his students, to whom he revealed a true nobility of conduct and a splendid character that was an inspiration to all who came within its influence.

The executive committee was instructed to provide, if practicble, for the printing of the address in separate form after its appearance in the proceedings.

M. H. Buckham, of Vermont, offered the following resolution:

Resolved, That the association desires to put on permanent record its high appreciation of the personal character and eminent public service of President H. H. Goodell, of the Massachusetts Agricultural College, and especially to bear testimony to his wise, brave, and faithful labors in commending to public comprehension and confidence the cause of real and practical education in agriculture in its early days of experiment and conflict. The association also recalls with grateful appreciation President Goodell's laborious and efficient services during his eight years' tenure of the office of chairman of the executive committee of this association.

The resolution was adopted by a standing vote of the association.

REPORT OF COMMITTEE ON INDEXING AGRICULTURAL LITERATURE.

A. C. True, of Washington, D. C., read a report from the standing committee on this subject, as follows:

Since the last meeting of the association printed catalogue cards have been issued for three standard foreign periodicals devoted to agriculture, "Annales de la Science Agronomique," "Landwirthschaftliche Jahrbücher," and "Die Landwirthschaftlichen Versuchsstationen." As is well known, these cards are prepared by the library of the Department of Agriculture and printed and sold by the Library of Congress. This cooperative arrangement for furnishing printed cards at a nominal price has been satisfactorily accomplished and now awaits sufficient encouragement from subscribers to warrant its continuation. There are at present only ten subscribers for complete sets and eleven subscribers for partial sets of the cards. It is estimated that the cards for complete and partial sets together are about equal to fifteen complete sets. This represents a small number of subscribers compared with the number of scientists throughout the country engaged in agricultural research work, and for whose benefit the cards are largely prepared. The question now presents itself after one year's trial, as to whether the demand is sufficient to continue this special indexing and to add other periodicals to the number to be indexed. To make it worth while to prepare, print, and distribute such cards, it is necessary to have thirty-five additional subscribers at least. If the agricultural college or experiment station of each State would subscribe for one set of the cards this would insure the continuance of this work and make it possible to provide individuals with whole or partial sets at reasonable cost. It is estimated that an annual subscription of $25 from each college or station would be required.

The above-mentioned periodicals have been indexed through 1904, and the copy for numbers published in 1905 awaits the decision of those most interested in the work as to whether it shall proceed. The cost to keep the indexing of these periodicals up to date will be small, but it is hoped that the subscribers will desire cards for one additional periodical each year until the indexing covers the representative agricultural periodicals.

It is a question whether the work thus inaugurated will in any case need the further attention of a standing committee of this association. It seems probable that the interests of the colleges and stations in this matter can be fully met through the library of the Department of Agriculture and the Office of Experiment Stations. The progress of the indexing will naturally be reported each year by the bibliographer of the association. Your committee therefore suggests that it be relieved from further service.

A. C. TRUE, *Chairman.*

H. P. ARMSBY, of Pennsylvania. I move that the report be accepted, and in making that motion I want to say just a word. Our station is one of the few which have purchased sets of these cards. I have not followed up the matter closely, but I must confess that I am very much astonished at the very small number of institutions which are reported by Doctor True as having taken advantage of this opportunity. I can not see how any station can afford to miss this opportunity. I do not believe we can afford in our station work to ignore the vast masses of material and experimental data which have been accumulated in the last fifty or sixty years in foreign countries, and especially in Germany. I do not see how we can make proper use of our funds while ignoring that and saying that we have nothing to do with work abroad. Of course the failure to purchase one of these sets hardly implies that; yet it almost suggests it. It seems to me it is an important matter, and with an index prepared by the library of the Department in this way and available at a cost which is insignificant, I can not see how any experiment station in this country can afford to be without it.

The report was accepted.

REPORT OF COMMITTEE ON RURAL ENGINEERING.

A report from this committee was read by W. E. Stone, of Indiana, as follows:

Your committee would report that during the past year there has been a perceptible advance in the public recognition of the need and value of specially trained agricultural engineers and an encouraging, if slight, progress in arrangements for giving this instruction in rural engineering in the colleges of this association.

The reasons for giving greater attention to this subject have been enumerated in the two previous reports of this committee and need not be repeated here. They are found in the changing conditions of farm life and farm labor in this country, and, being based on a fundamental need, they will endure and become more urgent and apparent until adequate provision is made.

Among the evidences of progress during the past season is the strengthening of the equipment in Iowa, the extension of the instruction in Cornell, and the provision for a complete course in rural engineering contemplated in Wisconsin. The strengthening of the work along experimental lines in a number of institutions is also clearly apparent, all showing an awakening attention to this subject. But along with this there are some unsatisfactory features. Chief of these seems to be the lack of a clear perception of the scope of courses in rural engineering, of what is required to equip young men to do the work needed to be done, of a lack of confidence in the value of courses of this character, which must be established before the best results can be obtained. In other words, the rural engineer is not yet a definite figure in this country, and our colleges are still floundering in their efforts to provide for his training.

In order to obtain a more definite understanding of what is regarded as rural engineering in the colleges represented in this association and the kind of training given under this classification, one of your committee mailed an inquiry as to the subjects taught, by what professor or instructor, the equipment for the work, and the plans for future development. The letter was unfortunately mailed too late for more than half of the colleges addressed to prepare and return replies. Those received, however, show that the greatest progress being made is in providing equipment for teaching and experimental work in farm mechanics, Iowa taking the lead in this, being followed closely by Cornell and Illinois. There are a number of western institutions giving complete courses in irrigation, Colorado and California giving the most thorough training, the work in both these institutions giving complete courses in irrigation engineering.

The replies, however, showed a wide diversity of opinion as to what is included in rural engineering. Some seem to indicate that elementary courses in carpentry and blacksmithing are entitled to this designation. This your committee regards as erroneous. They are related to the training, but they are no more entitled to be classified as a course in rural engineering than a few exercises in budding and grafting are to be considered a course in horticulture, or a few exercises in stock judging are to be classified as veterinary science. The only colleges which are entitled to claim that they are giving courses in rural engineering are those which fall within the definition given in Circular 45, the Fifth Report of the Committee on Methods of Teaching Agriculture, or those which are giving complete and independent courses of instruction in certain well-defined branches of rural engineering, like irrigation engineering or drainage engineering.

Another and more serious defect in the present instruction given by our colleges is the evident fact that the arrangements for giving this instruction are in too many cases mere makeshifts. In some of the colleges these subjects are taught by the department of civil engineering, in others by the department of mechanical engineering, and in others the work is a part of the department of agronomy. In one college it is taught by the department of mathematics, in another irrigation is taught by the department of horticulure, in another farm machinery is taught by the department of animal husbandry. All will agree that animal husbandry taught by the department of horticulture would be a somewhat anomalous arrangement. It might be justified on the ground that pigs will eat the fruit which falls from the trees, and hence there is a relation between the two subjects, but the teaching of animal husbandry by the professor of horticulture is no more ineffective than the attempt to develop an effective course in rural engineering by making it a part of horticulture or making it a part of animal husbandry.

Furthermore, there is a lack of recognition for those in charge. No one can fail to be impressed by the fact that, so far as the makers of courses of instruction are concerned, this work does not stand on an equality with the older established branches. Except for the colleges giving a course in irrigation engineering, no institution gives the man in charge of this work equal rank with the man in charge of other departments—such as agronomy, animal husbandry, horticulture, dairying, etc. Omitting those colleges teaching irrigation engineering, in only one college—Wisconsin—are courses in rural engineering recognized as a distinct department and accorded rank equal to other departments. In this respect the colleges of this country present a striking contrast to the recognition given this subject in the leading agricultural colleges of Europe. In Sweden, Denmark, Belgium, France, Netherlands, and Germany rural engineering is an independent department, with thorough courses of instruction and facilities for experimental work far in advance of anything yet contemplated in this country.

Your committee insists that the conception of this work given in the report of the committee on methods of teaching agriculture was a correct one and that the true value of this training, both to the student and to the development of the agricultural resources of this country, will not be achieved until courses in rural engineering are made as definite and independent as courses in animal husbandry, agronomy, and horticulture are now.

It is not believed that every institution should establish courses in rural engineering. Only those which have the equipment, or where the conditions of agriculture give opportunities for the following of this training, should undertake this. In States like California, where the investment in pumps for raising water in irrigation runs into millions of dollars, where the high price and scarcity of farm labor makes the use of costly and complex machinery imperative, and where irrigation and drainage are a prerequisite to the use of the greater part of the agricultural land, complete courses in this subject should be given, because a knowledge of them lies at the very foundation of successful agriculture, and young men equipped for this work have exceptional opportunities. Other institutions like Purdue, Illinois, Cornell, and many others which need not be enumerated, will, it is believed, find it in the line of progress to institute these courses.

Another fact brought out by the replies to these inquiries was that all that is needed in many institutions to provide for complete courses of instruction is a better correlation between existing departments, in order that each may give effectively its part of the training. It is believed that the establishment of courses in rural engineering will be an evolutionary process which will bring about a more complete fulfillment of the purpose of the Morrill Act. These colleges were established for the benefit of agriculture and the mechanic arts. The mechanic arts part has been developed into engineering colleges very similar in character to the best technical institutions of the country, but the agricultural courses and the mechanic arts courses are entirely separate from each other. Your committee believes that in the establishment of courses in rural engineering they can be made to greatly strengthen and help each other.

One thing which is doubtless in part responsible for this is the lack of textbooks, and these will not be provided until there has been a greater body of information brought together and systematized than is in our possession to-day. This means that there is need at present for experimental work. This is being recognized and provided for both by a number of colleges and by the Office of Experiment Stations of the Department of Agriculture. The work of the Office of Experiment Stations in tests of different types of pumping machinery and the conditions which affect its efficiency in the field will be of great service to the professors of mechanical engineering, because it will enable them to show the application of mechanical principles to the profit and loss of farm work.

Similar results are destined to follow the investigations of farm machinery now being inaugurated by a number of the agricultural experiment stations and by the Irrigation and Drainage Investigations of the Office of Experiment Stations in the Department of Agriculture. We must in the near future begin to consider as never before the economy of different types of farm machinery as compared to hand labor, and the relative economy of machines operated by horsepower and machines operated by gasoline, steam, or electricity. In determining this economy in a practical way, the mechanical knowledge and skill of the farmer himself are an important factor. Tests of pumping machinery show variations in efficiency from 5 per cent to 80 per cent. In other words, the fuel used in some engines gave sixteen times the service it did in others. A little of this was due to superiority in types of machinery. The greater part was in knowing how to keep it in proper working condition. In other words, there is the same opportunity for improvements in American farm practice in the line of machinery that has already been achieved in the breeding and management of plants and animals. This fact is being appreciated more clearly by the manufacturers of farm implements than by the farmers themselves. Every institution which has inaugurated investigations of farm machinery has been astonished at the liberality which the manufacturers of farm implements have shown in doing this work. The spirit of these manufacturers was strikingly illustrated at their recent annual convention at Niagara Falls, where the following resolutions were passed:

"*Resolved*, That we indorse and commend the agricultural engineering investigations of the United States Department of Agriculture, and believe their extension will benefit both the users and makers of farm machinery.

"*Resolved*, That a committee of three be appointed by the president to confer and advise with the proper governmental authorities about the conduct and extension of these investigations. We also recommend as features of these inevstigations the establishment of a laboratory and museum for the testing and illustration of principles of farm mechanics.

"*Resolved*, That we indorse and commend the teaching of farm mechanics and agricultural engineering in the various agricultural and other colleges, and that we pledge to all of this work our cooperation and support."

In conclusion, your committee expresses its belief that there is at the present time an urgent need in this country for a few institutions to establish independent courses in rural engineering, to rank with those now existing in some of the leading agricultural colleges of Europe, and that in order to do this these courses should be independent departments of the college, with adequate facilities for teaching and experimentation; that the men engaged in teaching such subjects should be classed as rural engineers and should have the same rank as professors in other departments; and that a vote of thanks be extended to the National Association of Implement and Vehicle Manufacturers for the aid and support they have already given to experimental work in farm mechanics; and that the efforts of the Secretary of Agriculture and Director True, of the Office of Experiment Stations, to enlarge these investigations, be commended.

W. E. STONE, *Chairman.*

The report was accepted and the secretary was instructed to extend the thanks of the association to the association mentioned in the report, in accordance with the recommendations of the report.

NUTRITION INVESTIGATIONS.

A. C. TRUE. As the work of the agricultural experiment stations developed, it seemed clear that it would be unwise for either the experiment stations or the Department of Agriculture to stop their studies of food products when they had studied questions relating to their production and use for farm animals; and so, under authority of law passed by Congress, investigations relating to the nutrition of man were authorized in the Department of Agriculture and assigned to the Office of Experiment Stations. At the same time, the agricultural experiment stations were authorized to carry on investigations on this subject. That was about twelve years ago. Since that time, especially under the direct leadership of Professor Atwater, though as a constituent part of the work of the Office of Experiment Stations, a very large amount of data has been accumulated along these lines. Much of this has been put in the form of publications, which have been widely distributed. These investigations have been carried on under a cooperative system by means of which a considerable number of the institutions represented in this association in different parts of the country have joined in the work.

Along with that there has been a very considerable development of departments of domestic science or home economics in the land-grant colleges, and this work on human nutrition has been used quite largely in the development of those departments. We have now reached a time in the progress of the nutrition investigations when it seems that it will be possible to make the results of this work much more largely useful to such departments of the colleges, and we are extremely desirous to do that. As you doubtless know, if you have followed at all the course of the departments of home economics in the different institutions, they have had the same problem that has confronted the other departments—namely, the development of sound pedagogic methods. Starting with work that was of an extremely simple and practical nature, they have been more and more desirous of putting the instruction on a sound college basis—that is, to give it a scientific basis and standing, so that the departments of home economics in colleges might take the leadership in that work as regards the lower schools. It must be borne in mind that at present there are thousands of schools in which subjects relating to domestic science and home economics are already taught. Thus far the work done along that line by the Office of Experiment Stations has related quite narrowly to human nutrition; but there are some other lines in which the Department of Agriculture has done some work, and as far as possible we desire to make such work also available and useful to home economics departments.

There is also a growing demand for a kind of work which will demonstrate more fully to the people at large the usefulness of such investigations and the practical advantages which may grow out of the application of science in various lines to the affairs of the household. So that, as it seems to those of us who have been close to this work, the time is ripe for a considerable development in this line of endeavor, and, in order that the Department may more efficiently do its part of such work, the Secretary has this year estimated for a somewhat larger appropriation. The increase, if obtained, is to be mainly spent in getting into closer relations with the teachers of home economics in the land-grant colleges and other institutions having similar departments, and also in demonstrating to a wider constituency the usefulness of such work. I am sure this is a matter in which the association is interested, and that it will cooperate in all good ways toward the building up of this enterprise, both by the Department of Agriculture and among the several institutions.

MISCELLANEOUS RESOLUTIONS.

On motion of H. C. White, of Georgia, the association expressed to President Stubbs its regret for his absence and its sympathy with him for the cause (death in his family).

On motion of E. A. Bryan, of Washington, the thanks of the association were unanimously voted the president of the association for the admirable way in which that office had been conducted during his incumbency.

The members of the convention, by special appointment, were received by the President of the United States. They were also extended the privileges of the Cosmos and University clubs during their stay in the city.

STANDING COMMITTEES.

The president announced the following standing committees:

Committee on instruction in agriculture: Three years—A. C. True, Washington, D. C., and T. F. Hunt, New York; two years—H. T. French, Idaho, and H. C. White, Georgia; one year—J. F. Duggar, Alabama, and W. E. Stone, Indiana.

Committee on graduate study: Three years—L. H. Bailey, New York, and H. P. Armsby, Pennsylvania; two years—M. H. Buckham, Vermont, and R. H. Jesse, Missouri; one year—W. O. Thompson, Ohio, and Brown Ayres, Tennessee.

Committee on extension work: Three years—K. L. Butterfield, Rhode Island, and C. R. Van Hise, Wisconsin; two years—B. W. Kilgore, North Carolina, and C. F. Curtiss, Iowa; one year—A. M. Soule, Virginia, and W. M. Hays, Washington, D. C.

Experiment station organization and policy: Three years—E. Davenport, Illinois, and C. D. Woods, Maine; two years—W. A. Henry, Wisconsin, and H. J. Waters, Missouri; one year—M. A. Scovell, Kentucky, and C. E. Thorne, Ohio.

Thereupon the convention adjourned sine die.

MINUTES OF THE SECTIONS.

SECTION ON COLLEGE WORK AND ADMINISTRATION.

Afternoon Session, Tuesday, November 14, 1905.

The section was called to order at 3 p. m. by the chairman, R. W. Stimson, of Connecticut.

Culture Studies in Land-Grant Colleges.

The first subject taken up for consideration was "To what extent should the baccalaureate degree courses of the land-grant colleges be severely scientific and technical—that is, inclusive or exclusive of so-called 'general-culture studies?'"

A. B. Storms, of Iowa, presented the following paper:

The Field and Functions of the Land-Grant Colleges.

Curriculum.—The avowed purposes of the land-grant colleges, according to the Morrill Act, being "to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life," to what extent should their baccalaureate degree courses be severely scientific and technical—that is, exclusive of so-called "general-culture studies?"

GENERAL EDUCATION AND TECHNICAL EFFICIENCY—"A MINIMUM GENERAL-CULTURE REQUIREMENT."

There are two important general considerations in determining what should be the scope and character of the courses of study in land-grant colleges—(1) the intent of the original land-grant act and (2) the evolution of the intent or idea in land-grant colleges. Seldom or never do the originators of any far-reaching and benificent idea conceive its execution in finished detail. Rather, they open a fountain of inspirational impulse. They initiate principles and outline the main working features of a plan. Broad-minded and benevolent statesmen, in devising plans for the future good of the race or of their country, are the last to wish to give stereotyped and rigid form to the details of their plans, knowing well that the vitality of a great purpose and fruitful idea requires a free atmosphere for its normal evolution.

Yet it is also true that a definite direction and limitation must be prescribed for the working out of an educational idea. Those have planned in highest wisdom who have either prescribed these limitations and given this definition only as governed by the main initial purpose, or have left the definition and limitation to be worked out in harmony with that central idea or purpose. No educational system can be successfully worked out that lacks consistency and coherence and organic unity within itself.

We should, therefore, ask as to the main features of the educational idea that found expression in the land-grant act. This, of course, is determined not only by the wording of the act itself, but by the discussions in Congress which led to the enactment. I think we may say, without attempting to resummarize the arguments, that the working of the act itself is a most happy expression of the central idea and purpose of the leading spirits who secured the land-grant enactment. That purpose is defined as being to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life. It was not the intention of the original movers of this act or of the Congress passing it that these colleges should be narrowly and severely and exclusively technical in their baccalaureate degree courses. A very interesting and instructive discussion of this very question arose in the State legislature of Iowa in 1884. The State of Iowa had founded in 1858 an agricultural college and model farm and had prescribed and limited its courses of study as follows: Geology, mineralogy, meteorology, entomology, zoology, animal and vegetable anatomy, veterinary surgery, and bookkeeping, and permitted no other studies except such as are directly in touch with agriculture. Desiring to take advantage of the national land grant, the legislature accepted the trust fund thus created and devoted it to the maintenance and enlargement of the agricultural college thus established by the previous act of the legislature. After a great deal of agitation and unrest the legislature in 1884 repealed the former act prescribing the courses of study, and enacted a new law providing that there should be adopted and taught at the Iowa State Agricultural College a broad, liberal, and practical course of study in which the leading branches of learning should relate to agriculture and the mechanic arts, but which should also include such other branches of learning as would most liberally and practically educate the agricultural and industrial classes in the several pursuits and professions in life, including military tactics. It will thus be seen that this bill proposed to change the law so as to provide a general and liberal course of study, in which agriculture and the mechanic arts should have a leading place, and to repeal the exclusive course that was provided by the statute. Senator P. M. Sutton, of Marshall, in an extended and extremely interesting argument before the senate, contended convincingly that to hold the land-grant funds to the narrow limitations of the previous law was a perversion of the trust funds by diverting them to a purpose quite different from the indication of Congress in passing the land-grant act.

The wisdom of this liberal purpose of Congress in the original act is worthy of all praise when we consider the character of the constituency of these colleges. The young men and women who go up to college in these institutions are very seldom prepared for or desirous of receiving a severely technical course. For the most part, the land-grant college is the only college and the only opportunity for higher education that these young people will find. These colleges are quite different from institutes of technology opened in the heart of great cities and in the midst of extensive manufacturing enterprises. Such technical institutes have for their sole purpose the technical education of specialists. It is not yet true, and probably never will be true, of the land-grant colleges that they are to be in the severe and narrow sense technical institutions.

There is a striking harmony between the utterances of the leading, aggressive educators of the present and the utterances of the men who urged forward the land-grant enactment. For instance, President Dabney, of the University of Cleveland, in his inaugural address makes the following statement:

"Since higher education produces more efficient men and thus increases the productivity, the wealth, and the power of the nation, it is the duty of the State or city to provide not only free schools, but colleges and universities for the higher training of its citizens."

And Doctor Barrows, general superintendent of education in the Philippines, in a recent address, says the ideals of the Philippine educational work include "a large, general purpose to raise the spiritual character, the industrial efficiency, and the political capacity of the entire people."

The land-grant law is a significant and notable expression of the ideal of modern democracy in the sphere of education. The old aristocratic notion of a scholarly class, whose hands should be unsoiled by labor and whose refined minds should be untainted by industrialism, has given way to the democratic ideal of equality. This does not mean that all men are alike capable of higher education and efficiency, but it does mean that the line of division between classes of men shall not be artificial and arbitrary, but natural and spiritual. The educational ideal of democracy is that the privileges of education and of higher education shall be open to all who have the initial ambition, the perseverance, and the talents to improve such opportunities.

These colleges owe their birth to the deep and generous enthusiasm of statesmen who felt the validity of the democratic ideal of equality. It is the glory of our western civilization that it has increased initiative and has multiplied the individual efficiency of the average man. And the ideals of the founders of these colleges being the legitimate expression in the sphere of education of that which is most characteristic of western civilization, must be cherished in an atmosphere of like generous enthusiasm and breadth of view.

We must consider the character of our students. They are largely from the thrifty industrial classes. They have virile manhood and womanhood. The elemental qualities that make for strength are there. Our first consideration must be such educational training and equipment as shall be calculated to raise "the spiritual character and industrial efficiency and the political capacity of the entire people." In the practical working out of our democratic system of education, we get, on the whole, the best material that was ever gathered within college walls. The initial implications as to character and personal force in the very fact of young men and young women seeking college training are extremely significant. The decision to enter college at all is a momentous one. It has large implications concerning the tone of life's ambitions and aspirations, It usually signifies a hunger for knowledge; an eagerness to get at books and to get into lecture halls and laboratories and to find the sources of information. An earnest and deliberate decision to enter college and to complete a full college course is usually itself an index of qualities of character, of intellect, and of will power that augur substantial achievement in life's work.

But we must also bear in mind that we live in a quite different age from that of the founders of these colleges. Their purpose and the scope of their work obviously were somewhat vague and indefinite at first. They were seeking a definition for themselves, a reason for their existence. Meantime there has been a most remarkable development in the fields of applied science—of science as related to the industries. The old single course in agriculture was quite a primitive and simple affair compared with the modern courses offered in the most advanced colleges of to-day. Instead of a general course called an agricultural course, offered in the Iowa State College of years ago, which contained a little general agriculture, with one professor giving such instruction as was given in the whole field of agriculture, we now have in agronomy proper nineteen distinct courses of study; in dairying, thirty; animal husbandry, twelve; horticulture, seventeen; agricultural chemistry, twelve; botany, with special reference to agriculture, nineteen; agricultural economics, one; rural law, one; or one hundred and eleven courses of study aside from the courses offered in the general sciences, in history, languages, mathematics, civics, etc. A like evolution, though not quite so radical or marked, has occurred in the schools of engineering. These courses, however, had a somewhat clearer and stronger development earlier, and the transition is not so marked. It is quite evident, however, in both the field of engineering and of agriculture, that the development has been so great and the demand has so increased for distinctively technical studies that these colleges might quite readily become purely and severely technical in all their baccalaureate courses.

When so many things are crowding for recognition in the curriculum and it comes to an issue between distinctively technical study and a general culture study, it is hard for the more general study to hold its own. The continual remodeling of the courses, the addition of new studies, would seem to threaten the exclusion at last of all the general culture studies. The question is a very pertinent one for us at this juncture, whether such a result is desirable, and if it be not desirable there should be some principle adopted by which the general culture studies shall have some minimum room given them in all courses offered for baccalaureate degree. In my judgment there should be such a minimum requirement of general culture studies in the first two years of the baccalaureate courses and some opportunity for electives in the last two years, and I say this knowing how difficult it is to make such provision, for instance, in a course of civil or mechanical engineering. These courses are already heavy. We can not add more studies to the requirements. I believe that the tendency has been overstrong to attempt the minute specialization in technical lines in our engineering courses particularly. It is a question to be seriously considered whether we should not react from this tendency and cease to expect to equip men for every distinctive technical field, and rather put the emphasis upon the fundamental principles of engineering, for example, or of civil engineering, if you please, and leave the student to develop those principles in the special field in which he may find himself after graduation. I was profoundly impressed by the statement made by Mr. John R. Freeman, vice-president of the American Society of Mechanical Engineers, on the occasion of the inauguration of Charles Sumner Howe, of the Case School of Applied Sciences, Cleveland, Ohio, in May, 1904. He summed up a very clear and forceful argument for a broad and thorough culture in technical schools in the following sentences:

"Recognize the fact that these four years' time with their attendant expenses are too valuable to be devoted to the attainment of mere manual dexterity. This can be more cheaply learned in the field or workshop than in the school. Do not shrink from turning out graduates who will be strong on theory while perhaps weak on practice. They can get their practice outside after graduation, and perhaps under the quickening influence of some short-lived ridicule by the routine workman, but the sound foundation of mathematics, the facility in handling and transforming difficult equations, the mental grasp of difficult considerations so as to state them in the language of mathematics and quantity, must be acquired in the technical school or the chances are that they will never be acquired."

Manifestly room should be found in every course that claims to be broadly educational for some comprehensive study of history that a man may be somewhat intelligent as to the forces and evolution of the political, social, and industrial institutions which he enjoys. Manifestly, too, he should study some other language than his own that he may have some facility in the use of a language as a means of expression. Manifestly, too, he should be a student of the English language throughout his entire course. He should be drilled constantly in the expression of his thought upon the subjects in which he is most interested. Of course the fundamental sciences—chemistry, physics, and mathematics—must have their place. They are fundamental not only in giving knowledge of principles, but as instruments of discipline. Along with these must be placed botany and zoology, the one or the other receiving emphasis according to the main course of study that may be taken. And along with the study of English must go the study of literature to a sufficient extent to give young men and young women somewhat independent standards of test. Civics and economics also may not be omitted. I would not go so far as President Howe has in his inaugural address, maintaining that philosophy and ethics and the history of art must also be included even in a technical course, but I would say with him, concerning the subjects that I have included, that a student can learn something of all these subjects during his college course and yet have a great deal of time left to follow his own individual tastes.

We must, indeed, prepare men thoroughly and not be content with superficial work in our technical courses. But the time has not come, and I believe it never will come, when the land-grant college should be severely and exclusively technical in its courses.

The question as to the amount of time to be given to general culture studies will be modified considerably by the nature of the entrance requirements. We in Iowa, for example, are now requiring for admission to the freshman year of engineering courses, besides English and elemental rhetoric, a semester of English literature, five hours a week; two years of French or of German; plain and solid geometry; history, and civics; or, in general terms, graduation from an accredited high school or its equivalent. Indeed, in mathematics few of the Iowa high schools are as yet including solid geometry. Many students will need to enter conditioned in solid geometry in the freshman year. In the civil engineering course, German or French five hours, both semesters; advanced rhetoric, five hours, one semester; composition, one hour, second semester; English history, one hour, first semester; formation of the Union, one hour, second semester; mathematics, five hours throughout the year; elementary engineering studies, three hours, first semester, and two hours, second semester, with possible election of two hours each semester in addition. The sophomore year, in addition to mathematics five hours throughout the two semesters, we have physics and chemistry and English, four hours of surveying, and one of drawing. In the junior and senior years the student's time is given almost exclusively to his technical engineering studies, with electives in history and English of two and of one hour. We would not claim that this arrangement of studies is entirely satisfactory, but it is the best that we have thus far been able to arrange. If the entrance requirements are low, relatively more time must be given to general studies within the college course proper. It should be recognized that a thorough high-school course is not in itself a mean education, nor should it be overlooked that technical studies have also a high cultural value.

There is a strong and significant tendency to bring educational interests near to the real interests of life. The cultural value of the sciences and of the applied sciences is being recognized as never before. Aside from learning thereby to do the things that need to be done in life, when properly pursued and with the requisite thoroughness and devotion, the sciences and the applied sciences furnish a discipline in education not inferior to that of the classics. Even the courses that seem mercilessly exclusive of general culture studies, as the course in architecture in the University of Illinois, include such subjects as the history of architecture, which is itself a most liberal and suggestive subject; for the spiritual ideals and aspirations of an age embody themselves in the architecture, and the history of architecture is in some large degree the history of the race.

J. M. Hamilton, of Montana, presented the following paper:

RELATIVE AMOUNTS OF PURE AND APPLIED SCIENCE IN THE LAND-GRANT COLLEGES.

The central thought in the title is science. Science in its broadest significance and widest meaning embraces all classified and organized knowledge. For the purpose of this discussion the scope of science will be limited to the knowledge of the forces and materials of the natural world. Such sciences as philology, metaphysics, etc., will not be considered as properly within the field of this inquiry. The mathematical, physical, and biological sciences will be deemed sufficiently comprehensive to mark a bound to the limits of this paper.

Furthermore, only that will be called "science" in which the factors of cause and effect are so completely known that before a theory is applied to a definite problem the results can be predicted with reasonable certainty. That part of astronomy which applies to eclipses is science. The kind, time, duration, and locality of an eclipse can be predicted with absolute certainty many years in advance, for all factors influencing the astronomical phenomenon known as an "eclipse" are known. The weather can not be forecasted with the same degree of certainty twenty-four hours in advance. Evidently there are forces at work in climate not yet fully understood. Meteorology has not attained the same degree of scientific perfection as astronomy. Communication between mind and mind happens occasionally, apparently without the ordinary media of thought transference. A theory of mental telepathy has been hypothesized upon these unexplained occurrences; but when a favorable environment is arranged and the telepathic message is started it so seldom reaches the intended destination that all claims to mental telepathy being a science fall to the ground.

By placing this limit upon the meaning of the word science an enormous amount of rubbish that frequently is exploited as science and often masquerades under the name is disqualified, and the discussion is thereby clarified. It is perfectly competent and highly desirable for investigators, teachers, and advanced students to labor with this undifferentiated mass of undigested material; for it is by such research that the boundaries of science are pushed back, and without empirical work little or no progress is possible in the increase of scientific knowledge. It is a question whether or not the average undergraduate student should be set to work upon those problems whose only claims to science are supported by nothing better than tradition, assertion, or opinion.

Science, as used in the title of this paper, is limited and qualified by the terms "pure" and "applied." In a legitimate sense all science is pure, in that it is truth; but for the purposes of this discussion pure and applied science will be considered mutually exclusive. Pure science is that part which has not been put to any economic use. Applied science is that part which has been utilized in the solution of the problems and situations of life. The effect of water upon plant growth is scientific knowledge which is directly applied in the economy of the world's food supply. A knowledge of the composition, size, and movements of the star Sirius does not affect the daily life of any. Between these two extreme examples there are thousands of other cases, shading imperceptibly into each other. The line of demarcation between pure and applied science is neither definitely nor permanently drawn. To-day some fact of supposed applied science proves unworkable and is relegated to the domain of pure science; to-morrow some concrete application is discovered for a hitherto wholly abstract principle. Perhaps the motive furnishes the best basis for classification. Scientific research that is carried on for the acquisition of truth only and the mere sake of extending the boundaries of knowledge is pure science. Scientific experiment conducted with the immediate end in view of utilizing the results in an economic problem is applied science. The factor of utility marks a fundamental difference between them.

A third limitation placed upon the discussion requires that it apply to the institutions represented in this association. This phase of the question necessitates an inquiry into the field and function of the land-grant colleges. Did Congress intend to duplicate the work of institutions then existing and equipped? Or did it propose to found a system of colleges to supplement some deficiency in the American educational system and duplicating, in part, established institutions of higher learning? Or was the aim to create an entirely new kind of college? Is the field of the land-grant colleges definite, special, and limited? In 1862 colleges and universities of diversified characteristics afforded American students varied opportunities for education. A few had been founded and endowed by philanthropists and were representative of the views of their individual promoters. Many were maintained by churches and were working out the ideals of their respective denominations. Some were State institutions and corresponded to the peculiar notions of particular States. What, then, caused the Congress to found a system of colleges distributed throughout the entire number of States and Territories, governed by a common law, and supported in part by national resources? Prior to this time the maintenance and control of public education had been considered the exclusive prerogative of the States. Evidently to the minds of the representatives of the people something was lacking in the work of existing institutions. In some respects none of them met the full, rounded, complete educational ideal of the nation. This was no freak measure, railroaded through Congress without due consideration. Several years of agitation, a number of defeats, including one Presidential veto, preceded the passage of the first Morrill Act. It was no sporadic effort, but an intelligent, persistent, national movement; was not representative of any individual cult or religion. Fortunately, the purposes and functions of the proposed institutions were concisely and definitely set down in the law, and there is small need for mistaking them.

It is only fair to assume that the lawmakers meant what they said; that they expected the usual rules of interpretation to be applied to the language of the law. The familiar and oft-quoted passage of the first Morrill Act contains some remarkable propositions. Five things stand out prominently in this declaration of educational principles: (1) Land-grant colleges were to be colleges, not elementary schools, not universities. The term "college" at that time had a well-known and definite meaning. Whatever the name attached to any particular institution, the work should reach college rank and grade. (2) "The leading object should be to teach such branches of learning as are related to the agriculture and the mechanic arts." "Other scientific and classical studies," while not excluded, were made secondary. (3) These subjects were to furnish both "a liberal and a practical education." It would not be necessary to pad the curriculum with the so-called "culture studies" to provide the liberal element. Agriculture, mechanic arts, and related subjects should do this. (4) These institutions were established especially for the industrial classes—not the poor alone, for the rich labor equally, and frequently more assiduously than the poor; nor the manual laborer only, but all whose labor bears directly upon the industrial development of the nation. (5) The training provided by these colleges should not only prepare for a pursuit, a vocation, but should rise to the dignity and the proportions of a profession.

The disposition of these colleges should be in such manner as the legislatures of the States should respectively prescribe. A land-grant college might constitute a unit in some great State university like Minnesota and California; or it might be united with a private foundation as at Cornell and Purdue; or it might be a part of a standard college, where the State provides for instruction in "other scientific and classical studies," as at Pennsylvania State College; or it might be an institution where chiefly subjects relating to agriculture and the mechanic arts are taught, as at the Michigan and Kansas agricultural colleges.

Twenty-eight years after the passage of the first Morrill Act and after these land-grant colleges had passed the experimental stage, the representatives of the people in Congress, in response to a popular demand, further endowed these colleges by an annual, direct appropriation out of the National Treasury. This second Morrill Act specifies the purposes for which this money may be expended, and this may consistently be considered a reiteration and an interpretation of the former law. This second declaration is notable for two things: First, it names the subjects for which instruction and equipment can be provided out of this national appropriation. Again, agriculture and the mechanic arts, like the name of Abou Ben Adam, lead all the rest. The related subjects are named as "the English language, and the various branches of mathematical, physical, natural, and economic science." Second, applied science is too dominant, for the law directs that the subjects named are to be taught with special reference to their application in the industries of life. These restrictions were intentional and premeditated, for the bill passed the Senate without them and they were inserted by amendment in the House of Representatives.

In 1862 less than a score of institutions of any rank were offering courses in the mechanic arts and much that was given was not above the grade of the high school manual training of to-day. Now, State, denominational, and private colleges and universities are eagerly searching for funds with which to establish and maintain departments of engineering and schools of technology. Then scarcely a half dozen institutions offered work in agriculture. Text-books in scientific agriculture had not been written; teachers had not been trained; courses of study had not been arranged; in fact, there was no science of agriculture. To-day agronomy, animal husbandry, and plant breeding rank with chemistry, physics, and biology as sciences. No other class of institutions has exerted such widespread influence upon the entire educational system of our country as these land-grant colleges. This influence, trickling down into the high schools, and even common schools, has besprinkled them with manual training and is now inoculating the rural schools with elementary agriculture. They are furnishing from among their graduates and faculties a goodly portion of the splendid army of workers in the Department of Agriculture. They have inspired the Government to plant by their sides the experiment stations, the grandest agencies for research work ever conceived and put into operation. To indicate the extent to which these institutions have pervaded and dominated the educational thought and ideals of the country it is only necessary to mention the fact that in 1905 the entering class in the Sheffield Scientific School was just about as large as the freshman class in Yale University. The record is all the more notable, because during the early history of these colleges the belief was almost universal among educators that science furnished an inferior training, and that the large element of utility in applied science rendered it almost worthless for educational purposes. Many of the instructors were saturated with this notion. Betrayed in its own house, industrial education was tolerated only because of the students it might attract and the appropriations which might be secured from granger legislatures.

In considering the relative amounts of pure and applied science in these land-grant colleges, preparatory values first attract attention because preparatory values are fundamental and primary. The foundation is unquestionably of first importance in the construction of any building. It is true that the foundation incloses no bedrooms, no kitchen, no parlor. It is usually deep in the ground, under the floor hidden by porches and accessories. But there it stands, and the entire building rests upon it for permanency, stability, and usefulness. Learn a lesson from the wise man "which built his house upon a rock; and the rains descended and the floods came, and the winds blew and beat upon that house and it fell not: for it was founded upon a rock;" and the foolish man "which built his house upon the sand, and the rains descended, and the floods came, and the winds blew and beat upon that house, and it fell." That engineering which is not well buttressed upon a massive foundation of pure mathematics is not worthy the name. Trigonometry and calculus must precede surveying and hydraulics. The animal breeder must first be a zoologist. The electrician must be prepared in the physics laboratory. Just as the lawyer who passes over the principles of common law and reads only the book of statutes is never more than a pettifogger, and the physician who neglects anatomy for the study of drugs is always a quack; so the agriculturist who is not grounded in theoretical chemistry and biology is but a plowman and a herder. "First the blade, then the ear, then the full corn in the ear." First the botanist, then the horticulturist, then the creator of new fruits. The civil engineer may pick up some knowledge of surveying in the field, but calculus never. The electrician may learn to operate a dynamo and motors by being connected with a power plant, but he will not absorb his physics in that way. The agronomist may acquire some knowledge of the analysis of soils while working with his crops, but he must get his principles of chemistry in the laboratory.

There will always be a large field for the so-called short courses in agriculture, domestic arts, and engineering. Such work, however, is intended for mature persons only, men and women who have passed the usual student period of life and are already in some vocation. The function of the short course is to improve those who are at work. These elementary courses, which extend over a few weeks, or months at most, can have but little of pure science in them. Such courses should be recommended to young people, if at all, with the aim of getting them into school, trusting to interest them in education and to influence them to go on to something higher and better.

The four-year courses in the land-grant colleges are to furnish the same liberal training as the literary and classical courses in other colleges. They are to give the same professional efficiency in agriculture and engineering as do schools of law and medicine. They must rest upon a four-year preparation. This preparation must be strong in algebra, geometry, physics, biology, and chemistry. Pure mathematics and pure science must hold a commanding position during the first half of the college courses. But it is just as grave an error to give nothing but pure science to prospective scientific agriculturists and engineers as it is to give none at all. Pure science is not in the curriculum because it affords a superior training, but for the very utilitarian reason that it is absolutely essential as a preparation for applied science. Pure science is narrow, isolated, and gives but a partial view of any applied-science problem. Applied science is cosmopolitan, comprehensive, and connected. Let me illustrate. Soil fertility, which is an applied science, embraces parts of the four pure sciences—chemistry, physics, bacteriology, and ecology. The chemist analyzes the soil and discovers what elements are lacking and what fertilizers should be applied. But, like one test for a poison, this may or may not reach the problem. And so while an agronomist must be a chemist a chemist is not necessarily an agronomist. The physicist prescribes a treatment for the soil which will enable the air to circulate freely through it and conserve the moisture. He gives direction as to methods of cultivation, summer fallowing, plowing under green crops, and breaking up the capillaries. But he sees but that one phase of the problem. Soil fertility is more than physics. The bacteriologist makes his diagnosis. He discovers nitrogen-fixing bacteria in the roots of legummous plants and that the success of crop rotation with clover and alfalfa is due to the presence of these bacteria. He prepares to inoculate the soil with the germs, and bacteriology becomes a factor in soil fertility. Last comes the ecologist and takes up the questions of mixed crops, cover crops, rotation of crops, and weeds. And thus parts of four pure sciences combined in the right proportion make up the one applied science of soil fertility. But four men working separately, each along his peculiar line of research, would never solve the problem, but one man combining work from the four view points will succeed.

The problem of irrigation is likewise composite. The civil engineer builds the ditch and constructs the head gate. He can measure the water that passes through the weir. But the agriculturist must give instruction as to the relative amounts of water required by different crops and different soils, how often the water should be put on, and at what season of the year, for he understands the effect of water on plant growth. But now the seepage water begins to evaporate on the next field below and brings to the surface the alkali of the soil. Immediately the chemist is requested to make an analysis, and the result foreshadows the ruin of the field. The civil engineer is recalled to put in a drainage system which will draw off the water turned on at the head gate.

A new insect pest appears in the cotton region, and at once the entomologist begins a series of experiments to determine the best method of limiting the affected area and ultimately to destroy the pest. At the same time the plant breeder undertakes to produce a variety of cotton with sufficient power to resist the pest. Each problem in applied science is complex and composite. It is the function of applied science to organize the separate facts of pure science into a coherent whole. Each individual science yields a part of the case, which, like any other half truth, may have the effect of a falsehood. A point is finally reached when the mathematician must either become an engineer or turn over his work to an engineer. The botanist must do likewise with the horticulturist. Every director of applied science has experienced trouble because the chemist climbed over into the field of the biologist or the botanist undertook the solutions of problems properly within the province of the bacteriologist, strife and duplication being the result. The solution of this vexed question involves the training of men of sufficient breadth to handle such problems as animal and plant breeding, soil fertility, and irrigation in their entirety. Even though these men only superintend the work, they must have the broad training.

The discipline derived from the study of any subject is of vital value. In judging any mental work a first consideration is power to produce scholars with the ability to do things. Until recently the formal discipline theory supplied the controlling principle in curriculum construction. The friends of this theory maintained that just as a man might accumulate capital in a factory and afterwards employ it in banking or commerce, so the student might develop skill in the study of the classics, which could afterwards be used in constructing a railroad, superintending a mine, or managing a ranch. Now, it is seriously questioned if there be any such thing as generalized habit. The habit of neatness in manuscripts acquired by the teacher of English does not always extend to his personal appearance. The habits of order and exactness shown in the class room of the mathematics teacher need not appear in his business affairs. Every athlete shows that the training necessary to develop the burst of speed of the sprinter will not create the endurance of the long-distance runner. Skill in the observation of the parts of a plant gives no assistance in mastering the letters of a word in spelling. Committing history names renders no aid in remembering scientific terms. Ability to interpret poetry yields no help in the interpretation of a scientific problem. No one expects a fish to live on land when the pond goes dry, nor the blacksmith who has lost his job to enter the employ of a cabinetmaker. The old educational maxim, "Learn to do by doing," needs no revision. If you want to learn to swim, jump into water, and waste no time climbing mountains; if you expect to fight in a modern army, get behind a Mauser rifle and take no chances with a leather shield and wooden spear.

Any so-called scientist can discourse as learnedly as Weismann upon the theory of heredity, but real business begins when the theory is put to the test in stock and grain breeding. It is of small consequence to a boy, set to determine the dimensions of the boards for the construction of a box, what answer he gets if the matter extends no further than a few figures on a slate which may be erased with a drop of water; but it is an entirely different affair when he takes a saw and a board and must cut them out. One man's guess at the weight of a cow is as good as another's until she is driven upon the scales. The student in trigonometry may not get beyond the diagrams and letters until he undertakes surveying. A school boy at Eton wrote upon the door of the Greek room, "This road leads to nowhere," and the professor aptly replied below, "But nevertheless a very good road for exercise." Who has not watched the first football eleven at signal practice? What an impregnable line! What perfect interference! But horrors, a few minutes later when the game begins, what breaking through the line! What smashing of heads and interference! The first is exercise, the second the real game.

Darwin in twenty-eight years of observation never proved that his theory of slow and gradual changes through environment would account for the origin of species. But De Vries quickly established his mutation theory in the greenhouse and nursery. The former held that monstrosities would not perpetuate their peculiar characteristics, and thus would become extinct; the latter showed that radical departures from the type fixed their individual qualities in their offspring. These observations are not offered as an argument against the study of classics and metaphysics. Neither are they intended to discredit pure science. The aim has been to secure a place in the household of disciplinary subjects for applied science.

The adjudication of the claim of pure and applied science in the curriculum of the land-grant colleges necessarily raises the question of the utilitarian value of knowledge. Educational values are subject to the same laws as commercial values. This statement will sound sacrilegious to many. Some will claim that there is a residue in education that escapes the tapeline of the practical man and refuses to be measured in terms of money. This position is a sentiment, a satisfaction, a joy, a culture. It prefers frayed clothes, chilly garrets, and cold potatoes; and this is proper enough for the eccentric few. Generally this same culture composes a poem and the friends of the author subscribe for enough copies of a de luxe edition to scare away the wolf; or writes a lecture and negotiates with some Young Men's Christian Association to exploit it at so much per night. There is an educational market just as surely as there is a grain market. In this market the venders and purchasers of educational wares meet to barter. Here the author with his story meets the reading public; the architect finds a contractor; the engineer consults the railroad promoter, and the doctor and the lawyer offer their services to the sick and those in trouble. Here Emerson brought his first volume of essays along with Morse and his electric telegraph. Here Walt Whitman offered his rhymeless poems and Edison his dynamo. Here some representative of the impressionist school of art will present a picture in competition with Burbank's latest creation in fruit. There is no virtue in any subject per se. There is much hypocrisy in the slogan, "Art for art's sake, work for work's sake, science for science's sake." There is no innate worth in wearing rags and going hungry. Rather a thousand times Mrs. Wiggs, with her half a score of urchins in the cabbage patch, than Thoreau, with his penny a day, living at Walden Pond. To-day the Titans of science are such men as Luther Burbank, in his California nursery; Perry G. Holden, in an Iowa cornfield, and Thomas A. Edison, in an electrical laboratory. These men represent a type of scientists who are professedly applying science, but at the same time pushing the boundaries of pure science back at a dizzy rate. While the Germans have increased the average percentage of saccharine matter in the sugar beet from 12 to 18, they have multiplied the knowledge of plant growth. While corn breeders have been running the comparative amounts of oil and protein up and down, they have been completing our fragmentary knowledge of the influence of heredity and environment upon plant life. While the problems of soil fertility are being worked out with nitrogen-fixing bacteria and the pulse family of plants, great progress is being made in conquering the mysteries of bacteriology. While electrical engineers are devising new means of utilizing electricity as a form of power to provide the comforts of life, wonderful theories are being constructed as to the very constitution of matter. Just as all honest and well-directed labor is respectable, timely, and essential, so all science rightly applied to the advancement of human civilization is profitable, honorable, and effective.

In conclusion the following sums up the points of the discussion:

(1) The land-grant colleges are essentially schools of applied science. This is necessarily true of any institution where the leading object is " to teach such branches as are related to agriculture and the mechanic arts in order to promote the liberal and practical education of the industrial classes." Applied science is emphasized by the law which directs that the largest Federal appropriation shall be used only for " instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their application to the industries of life and to the facilities for such instruction." The history and evolution of these colleges has been in accord with this spirit. Whether separate institutions or colleges in universities, wherever the Federal funds are being expended and the work authorized and required by the two Morrill Acts is being done, there is a center of applied science, an industrial school.

(2) A large amount of high-grade pure science is essential as a preparation for the applied science. Engineering must be based upon thorough work in geometry, trigonometry, and calculus. Agriculture must rest upon a firm foundation of biology, physics, and chemistry. This pure science work is provided not because it furnishes a training superior to surveying, mechanics, horticulture, and animal husbandry, but because pure science is a preparation for applied science. A four-year preparatory course containing a large portion of mathematics and science should be a prerequisite to all college courses in agriculture and the mechanic arts. Low standards encourage the engineering work to degenerate to the level of manual training and agriculture to become mere nature study. Pure science should dominate the first year of all the college courses. The second or sophomore year is early enough to begin specialization.

(3) The science work of the last half of the college courses, whether in agriculture or in engineering, should be thoroughly industrial. The problems of applied science are complex, composite, and comprehensive. They cover a wider range than any one pure science. A chemist or a biologist is not so well fitted to superintend plant breeding, animal breeding, soil experiments, etc., as one trained in horticulture, animal husbandry, etc. The teacher of pure mathematics does not presume to direct the work in civil, electrical, or other engineering. The two cases are parallel. It is because of the supplementing of pure mathematics by extensive training in hydraulics, machinery, electrical manipulations, etc., that engineering has reached the dignity of a profession and ranks with law and medicine. Scientific agriculture is fast approaching the same proportions through the work of the instructors and station workers in the land-grant colleges.

(4) The disciplinary value of any subject is a proper question for consideration in the construction of courses of study. The best thought of the day—and this view is confirmed by practice—seriously questions if the mental training acquired in one subject can be transferred to another. The best way to learn to do a thing is by doing that thing. Just as a mediocre carpenter can build a much better house than a first-class tailor, so each subject is incomparably the best trainer for its own work. One theory is as good as another until it is put to the test. In fact, the chief claim of some theories is that they can never be applied sufficiently to disprove them. The influence of heredity and of environment can be worked out only in the field, the nursery, the greenhouse. Practice makes perfect, and applied science is practice.

(5) The fact that the product of a piece of work can be put to some use does not necessarily degrade that work. Utility is not a synonym for unworthiness. There is an element of sacrifice in all training. No cow can produce the maximum of both milk and beef. No corn can yield the highest per cent of both oil and protein matter. Darwin bemoaned the fact that while he studied science he lost the power to appreciate poetry. But what Darwin sacrificed the world gained, for without those years of single-purpose labor the nineteenth century would not have been enriched by that master work, the Origin of Species.

Finally, there is no antagonism between pure and applied science, for applied science is simply carrying pure science out to its legitimate fruitage. Pure science has enriched applied science with some valuable discoveries. No doubt when applied science is better organized and more generally pursued it will return the favor. If the land-grant colleges are true to the ideals expressed in their charter laws, if they are true to the needs of their several immediate communities, if they are true to the spirit of industrial education, they will hold and increase their present leadership in the scientific development of the economic resources of this great country of ours.

COURSES IN AGRICULTURE, HORTICULTURE, AND ALLIED SUBJECTS.

F. W. Rane, of New Hampshire. A committee was appointed two years ago by the section of horticulture and botany of this association to outline courses in horticulture, and I happened to be made chairman. The other members of the committee were F. A. Waugh, of Massachusetts; J. Craig, of New York; R. S. Mackintosh, of Alabama, and U. P. Hedrick, of New York. The officers of the section on college work and administration have asked me to carry out that idea, also adding some other features. In the first place, we are all aware of the excellent work that has been done by the standing committee of the association on methods of teaching agriculture. Their reports have been printed,[a] and I have taken the course they recommend as a basis of the agricultural work. In the agricultural course recommended by that committee there are 180 hours that are designated for horticulture and forestry. Our committee, after looking over this course of 180 hours, has subdivided the subject of horticulture as follows:

HORTICULTURE—180 HOURS.

	Hours.
Propagation	20
Pomology (fruit growing)	50
Olericulture (vegetable gardening)	50
Floriculture (flowers and decorative plants)	30
Landscape horticulture	30
Total	180

The committee concluded that it was best to give a course in propagation, which really applies to all the various subdivisions that are given—pomology, olericulture, floriculture, and landscape horticulture—and therefore outlined a course in propagation, as follows:

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[a] U. S. Dept. Agr., Office of Experiment Stations Circ. 55.

HORTICULTURE, I. PROPAGATION—20 HOURS.

- **PROPAGATION.**
  - **By seed**
    - **Longevity of seed.**
    - **Storing seeds.**
    - **Testing seeds**
      - **In soil.**
      - **Artificial medium.**
    - **Sowing seeds**
      - **Time.**
      - **Seed bed.**
  - **By division**
    - **Detached parts**
      - **Specialized buds**
        - **Bulbs.**
        - **Bulblets.**
        - **Cormbs.**
        - **Tubers.**
      - **Sections of the plant**
        - **Cuttings**
          - **Tuber.**
          - **Root**
            - **Greenwood.**
            - **Hardwood.**
          - **Stem**
            - **Greenwood.**
            - **Hardwood.**
          - **Leaf.**
        - **Grafting**
          - **Cleft.**
          - **Whip.**
          - **Veneer.**
          - **Saddle.**
          - **Splice.**
          - **Bark.**
          - **Inlaying.**
          - **Seed.**
        - **Budding**
          - **Shield or T.**
          - **Ring.**
          - **Prong.**
          - **Plate H.**
          - **Flute.**
          - **Clip.**
    - **Parts intact**
      - **Suckers.**
      - **Stolons.**
      - **Layers.**
      - **Approach-grafting.**

Twenty hours is not a great amount of time for this subject, but for the student taking a four-years' course in agriculture this will cover propagation fairly well. We next allow pomology 50 hours out of the 180 hours.

HORTICULTURE, II. POMOLOGY—50 HOURS.

- INTRODUCTION
  - Definitions.
  - Place in general horticulture.
  - Recent development as an industry.
- CLASSIFICATION OF FRUITS
  - Orchard.
  - Vines.
  - Small.
  - Nonwoody or herb-like.

- ORCHARD FRUITS
  - Pomaceous fruits
    - Apple.
    - Pear.
    - Quince.
  - Drupaceous or stone fruits
    - Plum.
    - Cherry.
    - Peach and nectarine.
    - Apricot.
  - Citrus fruits
    - Orange.
    - Lemon.
    - Lime.
    - Citron.
    - Shaddock, etc.
  - Nut fruits (nuciculture)
    - Walnut.
    - Butternut.
    - Pecan.
    - Hickory.
    - Chestnut.
    - Filbert and hazel.
    - Almond, etc.
  - Palmaceous fruits
    - Cocoanut.
    - Date, etc.
  - Miscellaneous
    - Persimmon.
    - Olive.
    - Pawpaw.
    - Fig.
    - Mulberry.
    - Pomegranate.
- VINE FRUITS (VITICULTURE)
  - Table grapes
    - American origin.
    - Foreign origin.
    - Hybrids.
  - Wine grapes.
  - Raisin grapes.
- SMALL FRUITS
  - Bush fruits
    - Raspberries.
    - Blackberries.
    - Currants.
    - Gooseberries.
    - Juneberries.
    - Buffalo-berry.
    - Dewberries.
  - Strawberries.
  - Cranberries.
- [illegible] FRUITS
  - [illegible]
  - [illegible]
  - [illegible]
- [illegible]
  - Botanical knowledge.
  - History.
  - Importance and extent of cultivation.
  - Soils and locations.
  - Plant food (fertilizers).
  - Propagation.
  - Planting.
  - Tillage.
  - Pruning.
  - Spraying.
  - Thinning.
  - Picking, harvesting.
  - Marketing.
  - Storage.
  - [illegible]
  - [illegible]
    - [illegible]
    - [illegible]
  - [illegible]

NOTE.—Lectures, recitations, and laboratory exercises are to receive their due apportionment with all the crops.

Following pomology comes olericulture (vegetable gardening), to which 50 hours are given. This subject is subdivided somewhat as pomology.

HORTICULTURE, III. OLERICULTURE—50 HOURS.

- INTRODUCTION
  - Definitions.
  - Place and importance in horticulture.
  - Recent developments as an industry.
- GARDENING, KINDS OF
  - In the open
    - Natural.
    - Under irrigation.
  - Under glass
    - Cold frames.
    - Hotbeds.
    - Glass structure
      - Heat
        - Fermenting materials.
        - Hot air.
        - Hot water.
        - Steam.
      - Houses
        - Even span.
        - Shed roofs.
        - Two-thirds span.
        - Three-fourths span.
        - Miscellaneous.
  - Seed growing
    - Private use.
    - Commercial use.
- CLASSIFICATION OF VEGETABLES
  - Root crops and tubers.
  - Alliaceous group.
  - Leguminous group.
  - Brassicaceous group.
  - Solinaceous group.
  - Cucurbitaceous group.
  - Salad plants and pot herbs.
  - Miscellaneous vegetables.
  - Sweet herbs.
  - Mushrooms.
- ROOT CROPS AND TUBERS
  - Potato.
  - Sweet potato.
  - Radish.
  - Beet.
  - Parsnip.
  - Carrot.
  - Turnip.
  - Horse-radish.
  - Salsify and scorzonera.
- ALLIACEOUS GROUP
  - Onion.
  - Leek.
  - Garlic, chives, etc.
- LEGUMINOUS GROUP
  - Peas.
  - Beans.
- BRASSICACEOUS GROUP
  - Cabbage.
  - Kale.
  - Brussels sprouts.
  - Cauliflower.
  - Broccoli.
  - Kohl-rabi, etc.
- SOLINACEOUS GROUP
  - Tomato.
  - Eggplant.
  - Peppers.
  - Physalis.

CUCURBITACEOUS GROUP	Cucumber. Muskmelon. Watermelon. Squash. Pumpkin, etc.
SALAD PLANTS AND POT HERBS	Spinach. Lettuce. Cress. Corn salad. Endive. Chicory. Dandelion. Mustard. Chard. Sorrel. Parsley. Rhubarb.
MISCELLANEOUS VEGETABLES	Celery. Celeriac. Asparagus. Sweet corn. Okra, or gumbo. Martynia. Artichoke.
SWEET HERBS	Sage. Lavender. Peppermint. Catnip. Caraway, etc.
MUSHROOMS	Edible species.
Syllabus to be followed with each group, crop, or individual plant	Botanical knowledge.. History. Importance and extent of cultivation. Soils and locations. Plant food (fertilizers). Propagation. Planting. Culture. Training. Pruning. Thinning. Picking (harvesting). Marketing. Storing. Varieties. Spraying for insects. Spraying for diseases. Profits (estimated).

NOTE.—Lectures, recitations, and laboratory exercises are to receive their due apportionment with all the crops.

Floriculture is given 30 hours, and is subdivided as follows:

HORTICULTURE, IV. FLORICULTURE—30 HOURS.

INTRODUCTION	Definitions. Place in general horticulture. Value in illustrating intensive agriculture. Relation to landscape gardening.

- **Kinds of work**
  - Out of doors.
  - Under glass
    - Greenhouse construction.
    - Greenhouse management.

- **Greenhouse construction**
  - History and evolution of glasshouses.
  - Types of houses
    - The lean-to.
    - The even span.
    - The three-quarter span.
    - Curvilinear roofs.
    - Houses for special crops.
  - Building materials
    - Foundations and walls.
    - Walks and benches.
    - Roof structures.
    - Glazing.
    - Ventilators.
  - Heating
    - Steam.
    - Hot water.
    - Furnace.
    - Piping.
    - Fuel.

Commercial cut flowers: Rose, carnations, violets, chrysanthemum, sweet peas, etc.

Bulbous and tuberous plants: Narcissus, lilium, hyacinth, cyclamen, filesia, jonquils, etc.

Ornamental foliage plants: Palms, ferns, croton, dracarna, maranta, araucaria, selaginella, pandanus, etc.

Ornamental flowering plants: Azalea, cineraria, primula, genista, fuchsia, etc.

- **Bedding plants**
  - Bulbous: Cana, tulip, crocus, caladium, begonia.
  - Not bulbous: Geranium, coleus, salvia, ageratum, alternantheræ, iresine.

- **Orchids**
  - Terestrial.
  - Epiphytal.

- **Aquatics**
  - Nymphea.
  - Nelumbium.
  - Victoria.

- **Cacti**
  - Opuntia.
  - Cereus.
  - Phyllocactus.

- Syllabus to be followed with each group, crop, or individual plant.
  - Botanical knowledge.
  - History.
  - Importance and extent of cultivation.
  - Soils and locations.
  - Plant food (fertilizers).
  - Propagation.
  - Planting.
  - Culture.
  - Training.
  - Pruning.
  - Thinning.
  - Picking (harvesting).
  - Marketing.
  - Storing.
  - Varieties.
  - Spraying
    - For insects.
    - For diseases.
  - Profits (estimated).

Note.—Lectures, recitations, and laboratory exercises are to receive their due apportionment with all the crops.

To the last division, landscape horticulture, 30 hours is given.

HORTICULTURE, V. LANDSCAPE HORTICULTURE—30 HOURS.

The committee had difficulty in deciding upon an outline for landscape horticulture, so it was decided to assign 30 hours for that subject without an outline.

OTHER FEATURES OF THE COURSE.

There are a few features which we wish to bring up for discussion. In the first place, referring to the course recommended by the committee on methods of teaching agriculture, you will see that in the freshman year 150 hours are given to physics, 150 hours to chemistry, 155 hours to geometry and trigonometry, 120 hours to English, and 180 hours to modern languages, etc., as follows:

Agricultural course in college.[a]

Freshmen.		Sophomores.		Juniors.		Seniors.	
Subjects.	Hours.	Subjects.	Hours.	Subjects.	Hours.	Subjects.	Hours.
Physics	150	Agriculture: Zootech . 60 Agron ... 90	150	Agriculture: Agron ... 50 Zootech. 100	150	Agriculture: Dairying . 70 Farm mechanics . 60 Rural economics . 60	190
Chemistry	150	Meteorology	60	Geology	120	Veterinary medicine	180
Geometry and trigonometry	155	Agricultural chemistry	180	Botany	60	Horticulture and forestry	180
English	120	Botany	120	Physiology	180	History and political economy	130
Modern language	180	English	80	Zoology	120	Ethics	40
		Modern language	100	Psychology	60		
		Drawing	60	Modern language	60		
	755		750		750		780

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[a] A general outline of this course, without reference to its division according to years, was given in the second report of this committee. (See U. S. Dept. Agr., Office of Experiment Stations Bul. 49 and Circ. 37.) The number of hours assigned to each subject includes the time given to laboratory exercises, each of which would occupy two hours. Thus, for example, 150 hours of physics may be divided into 60 lectures or recitations and 45 (=90 hours) laboratory exercises. Our committee has not attempted to say how the time should be divided between lectures or recitations and laboratory exercises, but presupposes that a reasonable number of laboratory exercises or practicums will be given in all the science courses.

A committee on courses in botany, which reported to this association two years ago, recommended that this subject be given 240 hours instead of the 180 assigned in the above outline. Botany, as the table shows, begins in the sophomore year and ends in the junior year. Horticulture is largely economic botany. It is absolutely necessary that horticulture should have a good foundation in botany, and if the botany is not begun until the sophomore year and is finished in the junior year, of course it is impossible to get horticulture until the last or senior year.

I appreciate very much the work that the committee has done in recommending this course in agriculture. I do not care to criticise this course in any way, but, looking at it from a horticultural standpoint, I wish to bring out some of the features that the horticultural men of this committee criticise, respecting the question of horticulture. We are fairly well satisfied, in a way, with 180 hours for horticulture, but we do not like its placing in the course. Also, the course is not elastic enough for one bearing so general a title. Horticulturists feel that they are interested in the general agricultural course as much as the agriculturists. In fact, it seems the time has come when the professor of agriculture has no particular monopoly upon the agricultural course any more than the professor of horticulture, or any more than the professor of animal industry or dairying, or many of the other lines. The professor of horticulture is interested in giving horticulture earlier than the senior year. It often happens that in many of our institutions men graduating in agriculture are prepared and do go out, after their general agricultural course, as professors of horticulture, and they are fairly well prepared for that work. Therefore the committee as a whole would recommend that the horticulture begin earlier in the course, and thus give the men an opportunity to specialize, if they want to, in the senior year. In order to do this it is necessary to put the botany earlier in the course (see p. 88).

A COURSE IN HORTICULTURE.

The programme committee of this section asked me also to outline an ideal course in horticulture. I conferred with the various members of the committee, and we have gotten together a course which is based entirely upon the "agricultural course" before given. The idea is to give a course in horticulture exactly parallel to that in agriculture, except that a man starts out in the freshman year with the idea of finishing a four-year course in horticulture. This course includes, as will be shown by comparison, all of the principal fundamental subjects found in the other course, but arranged to suit horticulture.

Horticultural course in college.

[The number of hours assigned to each subject includes laboratory exercises. The committee presupposes that lectures, recitations, and laboratory exercises will receive their due apportionment in all the science courses.]

Freshmen.		Sophomores.		Juniors.		Seniors.	
Subjects.	Hours.	Subjects.	Hours.	Subjects.	Hours.	Subjects.	Hours.
Botany	90	Horticulture (propagation)	60	Horticulture: Pomology 120 Olericulture 120	240	Horticulture: Pomology 80 Floriculture 75	155
Chemistry	150	Agriculture	60	Agriculture	120	Landscape gardening	60
Geometry and trigonometry	155	Physics	90	Geology	120	Forestry	40
Surveying	60	Agricultural chemistry	90	Botany	90	Agriculture: Rural economy 60 Farm mechanics 60	120
English	120	Botany	90	Physiology	60	History and political economy	190
Modern languages	180	Zoology	120	Psychology	60	Ethics	40
		English	80	Modern languages	60	Elective or thesis subject	175
		Modern languages	100				
		Drawing	60				
	755		750		750		780

Classification of studies.

Nature of subjects.	Freshmen.	Sophomores.	Juniors.	Seniors.	Entire course.
	Hours.	*Hours.*	*Hours.*	*Hours.*	*Hours.*
Culture	300	240	120	230	890
Pure science	395	390	270		1,055
Applied science (required)	60	120	360	375	915
Applied science (elective)				175	175
Total	755	750	750	780	

Botany is given 90 hours in the freshman year instead of beginning in the sophomore year. Chemistry is given 150 hours, as before. Physics is cut from 150 hours to 90 hours and placed in the sophomore year. Geometry and trigonometry are given 155 hours, the same as before. Surveying, 60 hours has been added. English and the modern languages remain exactly the same. Therefore the only difference is in regard to the question of pure science. We have in this case 395 hours, as compared with 455 hours of pure science in the other course. Dividing the subjects up, we have: Cultural subjects, 300 hours; pure science, 395 hours; applied science (surveying), only 60 hours. In the sophomore year we introduce the 60-hour course in propagation. We also realize that agronomy is important to the horticultural men—and this is also true of soil physics and subjects of that nature—and therefore we have given 60 hours of agronomy in the horticultural course. Agricultural chemistry we have given 90 hours, as against 180 hours. Botany we have given 90 hours. This gives 180 hours, as against 120 hours. Zoology is brought back from the junior year, considering it a primary fundamental pure-science subject, our idea being to get it in the earlier portion of the course rather than let it remain over later, because a great many of our horticultural subjects should begin in the junior year rather than later; and zoology, especially entomology, is work fundamental to these subjects. English, the same, 80 hours; modern languages, the same, 100 hours; drawing, 60 hours, the same, giving 750 hours in all. Totals: Cultural subjects, 240; pure science, 390; applied science, 120—750 hours in all. In the junior year we are prepared to begin our horticultural work, and we have pomology and olericulture, beginning with 120 hours each.

It is necessary for a student in horticulture to know something about the economic feeding of animals and breeds of animals. To meet this need agriculture, 120 hours, is added. Geology, 120 hours, the same; economic botany, 90 hours; physiology, 60 hours, reduced from 180; psychology, 60 hours; modern languages, 60 hours, both the same. This divides up the junior year into cultural subjects, 120; pure science, 270; applied science, 360 hours.

In the senior year we have pomology, 80 hours, floriculture, 75 hours; landscape gardening, 60 hours, forestry, 40 hours.

We take here again the feature of the agricultural course, which we think the horticultural man should have, and include 60 hours of farm mechanics and 60 hours or rural economics, making in all 120 hours. We leave out the dairying simply because many horticultural students do not care about the dairying. They can elect it, however, if they want it. History and political economy remain the same, 190 hours, and ethics the same, 40 hours. Then we have 175 hours for elective or thesis subjects. If a student cares to take dairying he can get it in this 175 hours, or he can select 175 hours from any other subject or subjects he wants. In fact, the electives here really give an opportunity for students to carry the agriculture in the agricultural course. This is where we feel that we can afford, after giving required studies, to allow the student to select 175 hours. There is a great advantage, it seems to us, in this. This allows a student to use his own ideas as to what he wants. Some men think we do not have sufficient of the cultural side and others of the pure science in the agricultural course. For instance, in chemistry there are 150 hours in the freshman year and 180 hours in the second year of the agricultural course. It seems to us that is not well balanced as regards chemistry. If a man wants more chemistry in this course here is his opportunity to elect it; so with other subjects. In other words, a man is given an opportunity to elect in the senior year 175 hours.

COMPARISON OF HORTICULTURAL COURSES IN DIFFERENT INSTITUTIONS.

A study of the comparative amount of horticultural work, both required work and elective work, in the agricultural courses of various institutions taken at random, for examples, New York, Illinois, California, Michigan, Pennsylvania, Missouri, Massachusetts, Ohio, and New Hampshire, shows that subjects coming under the head of horticulture in these various institutions are apparently, first, propagation, then pomology, olericulture, floriculture, greenhouse management, principles of horticulture, plant breeding, horticultural seminar, landscape gardening, handicraft, viticulture, and nut culture. They are shown in the following table:

Number of hours horticulture is required and elective in agricultural courses in various institutions.

	New York.		Illinois.		California.		Michigan.	
	Req.	Elec.	Req.	Elec.	Req.	Elec.	Req.	Elec.
Propagation		54		90	36	36	60	60
Pomology		90		126	54	54	100	100
Olericulture		18		144			60	60
Floriculture				126				60
Greenhouse management		36		90			48	48
Principles of horticulture			90	90				
Plant breeding		18		45				24
Horticultural seminar		36		45				48
Landscape gardening		72	54	54	18	18	30	30
Handicraft		36						
Viticulture				45	18	72		
Nut culture				45				
Total	00	360	144	900	126	180	298	430
Year started	Junior.		Fresh.		Junior.		Soph.	

	Pennsylvania.		Missouri.		Massachusetts.		Ohio.		New Hampshire	
	Req.	Elec.	Req.	Elec.	Req.	Elec.	Req.	Elec.	Req.	Elec.
Propagation	90	90	54	54	54	54	54	54		
Pomology	90	90	54	54	54	108	54	108	45	90
Olericulture			18	18	36	72		138	35	80
Floriculture						108		54	30	
Greenhouse management		81							30	50
Principles of horticulture							54		30	
Plant breeding		81	18	18		72		48	30	
Horticultural seminar						36				20
Landscape gardening			18	18	72	288		48		30
Handicraft										
Viticulture										
Nut culture										
Total	180	342	162	162	266	638	162	450	200	270
Year started	Soph.		Fresh.		Soph.		Junior.		Fresh.	

At Cornell horticulture is not required in the agricultural course. On the other hand, the student can elect any of the various subjects named in the adjoining column. He can elect 54 hours of propagation, 90 of pomology, 18 of olericulture, 36 of greenhouse management, and so forth.

In Illinois the only requirement is 90 hours in the principles of horticulture and 54 hours in landscape gardening. But, on the other hand, students have the opportunity of electing from many courses. Cornell gives 360 hours of horticultural electives. Illinois requires 144 in the four-year agricultural course, and they allow as elective 900 hours, the largest we have, I think.

In California 36 hours are required in propagation, 54 hours in pomology, 18 hours in landscape gardening, and 72 hours in viticulture. Therefore, 126 hours are required and 180 hours only are elective. In Michigan 298 hours are required and 430 hours are elective. In Pennsylvania 180 hours are required and 342 hours are elective. In Missouri 162 hours are required and 162 are elective. Here is an institution where all the horticulture is required in the regular agricultural course. In Massachusetts 266 hours are required and 638 hours are elective. In Ohio 162 hours are required and 450 hours are elective. In New Hampshire 200 hours are required and 270 hours are elective. It is very interesting to compare these data. If a position opens up in horticulture for a student graduating in a four-year course in agriculture—for instance, in Michigan or some other institution—he is prepared to handle it, as the work goes hand in hand with agricultural training. Other institutions do not require so much horticulture, and the graduates do not feel prepared to teach it. It seems to me that there is this to be said—that the more a man studies our agricultural courses the more he is convinced that we are in a very chaotic condition as regards the pedagogy in our various institutions. Horticulture is not the only subject that varies. It strikes me that the same thing is true to a certain extent with the amount of animal industry, agronomy, etc., in our four-year course in agriculture in various institutions. Some of the men graduating from our four-year courses in agriculture are better prepared as chemists than they are in agriculture, or perhaps, putting it more mildly, I should say that they are equally as well prepared in chemistry as agriculture. The same thing may be said of many other subjects, according to the institution in question.

A STANDARD AGRICULTURAL COURSE.[a]

After a close study of all the courses the following is offered for your consideration: The agricultural course offered by the committee on methods of teaching agriculture of this association is a strong course, and it represents a feature of development in agricultural education. But it is primarily a course for grain-growing and stock-raising agricultural men. Now, it seems to me that what we want to get at in our various institutions touching agriculture is fundamental or foundation work in botany, chemistry, physics, geology, and zoology as pure sciences. It seems to me we ought to give some sort of idea as to the amount of these fundamentals that should be required by every agricultural institution in the country. I do not see why we can not agree as to a standard in this respect. It is not my purpose, by any means, to give more chemistry than is desired, or any other pure science than is desired by scientific men generally, but to propose a standard which all men should come up to.

As far as an examination of catalogues will show, none of the agricultural colleges is following out the excellent schedule offered by the standing committee of this association. For instance, horticulture is not given 180 hours in the senior year, as recommended in this schedule. It begins in New York in the junior year, in Illinois in the freshman year, in California in the junior year, in Michigan in the sophomore year, in Pennsylvania in the sophomore year, in Missouri in the freshman year, in Massachusetts in the sophomore year, in Ohio in the junior year, in New Hampshire in the freshman year. In order to give the instructors in horticulture, forestry, veterinary science, dairying, entomology, etc., a fair chance to interest students in these particular features the electives should come earlier in the courses than the senior year. Instead of allowing the instructors in dairying to give the student 70 hours in the senior year, as required, we are giving him an opportunity to get in touch with the men with fewer hours in the junior year, so that they can develop that phase of work later if they care to. I believe in the postgraduate courses. On the other hand, the great majority of these men graduate in the four-year course, and they will not take the time and perhaps can not afford to take a postgraduate course. They should therefore have some opportunity for specializing before graduating in this four-year course. If the elementary sciences are put in the forepart of the elementary course, and the standard requirements of applied sciences in agriculture brought in by the end of the junior year, then we could give the student a right to select his own occupation and let him work out his problem for himself. The course here offered is founded on that assumption.

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[a] By the chairman of the committee only.

A standard agricultural course.

Freshmen.		Sophomores.		Juniors.		Seniors.	
Subjects.	Hours.	Subjects.	Hours.	Subjects.	Hours.	Subjects.	Hours.
Botany	100	Botany	100	Agriculture: Agronomy ... 50 Zootechny ... 100 Agrotechny 40	190	Rural engineering	60
Chemistry	100	Chemistry	100	Veterinary medicine	100	Rural economy	60
Physics	100	Geology	100	Surveying	40	Landscape gardening	30
Zoology	100	Physiology	100	Shop work	30	Plant breeding	30
Geometry and trigonometry	100	Agronomy (clmate, soil, etc.)	50	Forestry	30	History and political science	190
English	100	Plant propagation	50	Horticulture: Pomology 50 Olericulture ... 50 Floriculture ... 30 Landscape horticulture ... 20	150	Ethics	40
Modern languages	150	English	100	Psychology	60	Electives	370
		Modern languages	100	Modern languages	50		
		Drawing	50	Elective	100		
	750		750		750		780

Classification of studies.

Nature of subjects.	Freshmen.	Sophomores.	Juniors.	Seniors.	Entire course.
	Hours.	*Hours.*	*Hours.*	*Hours.*	*Hours.*
Culture	250	250	110	230	840
Pure science	500	400	....	....	900
Applied science (required)	....	100	540	180	820
Applied science (elective)	....	....	100	370	470
	750	750	750	780	....

The scientific way of teaching should be to have the fundamentals first, early in the course, so the others can follow them. In this "standard course in agriculture" I have placed the elementary sciences in the first two years of the agricultural course. The idea is to place botany on the same basis as chemistry. I can not see why chemistry should monopolize the agricultural student any more than botany. Botany is an elementary science, one of the fundamental sciences of agriculture, it seems to me, if anything is. Botany should begin the first year. I place all of the elementary sciences on the same basis. I have therefore given botany, chemistry, physics, zoology, geometry, and trigonometry (mathematics) each 100 hours, English 100, and modern languages 150 hours. This adds up for the freshman year as follows: Culture, 250; pure science, 500; applied science, nothing; total, 750 hours.

In the sophomore year we continue these elementary sciences—botany, 100; chemistry, 100; geology, 100; physiology, 100; agronomy (particularly climate, soil, etc.), 50; plant propagation, 50; English, 100; modern languages, 100, and drawing, 50 hours, making in all the total of 750 hours. This is subdivided, showing culture, 250; pure science, 400. We now just begin the economic or applied sciences—100 hours.

The student now has his foundation work for an agricultural course. Why give elementary A B C work up in the junior and senior years? Why not bring them back into the first two years? It may be a great deal of pure science. At the same time these sciences go hand in hand; a great many things in one subject dovetail into another after the student has finished the pure sciences. Now, what should be required in the agricultural course? Our agricultural men should have certain broad ideas of agriculture. Agriculture to-day is a broad subject. If a man is an agriculturist he ought to know not only agronomy and animal husbandry, but general agriculture. Therefore, as shown in the accompanying course, in the junior year a general foundation in applied agricultural subjects is required of all students, the number of hours given being only enough to comprehend and understand the respective subjects sufficiently to give them their due recognition in the training of an agricultural graduate. It is an advantage for the agricultural graduate to know something about landscape gardening, how to grow trees, and the adornment of grounds from an educational standpoint. Besides we have allowed 100 hours as elective in the junior year. A great many say that we do not give sufficient work in culture. Now, 100 hours will balance that up, letting each man select according to his tastes.

Passing on to the senior year, mechanics and rural economics, each 60 hours, are required, the same as in the other course, because it seems desirable for all students taking the four-year course to have these courses. Landscape gardening is given 30 hours, because it seems that every man graduating in agriculture ought to have just a taste of the esthetics of agriculture. A man ought not to know simply cows and farm crops. He ought to know something about home embellishment and about making and caring for the home. He ought to be a citizen that will lead the community in making country parks and in the question of beautifying the grounds around the schoolhouse, and have some taste in such directions which a great many of our boys will never get unless it is made a requirement. Plant breeding is given 30 hours, history and political science the same as required in the other course (190 hours); ethics, 40 hours, the same as required in the other course. We have left, after requiring all these subjects, in the senior year 370 hours to bring the schedule up to the full number of hours. This gives the student, as I have already intimated, an opportunity to continue to take any of the various subjects that he has studied or select anything new he cares for. If he wants to get more chemistry, zoology, or any of the sciences, he can do it. He can go into any of the various subjects of applied science deeper or he can go back and take modern languages or more philosophy or ethics, if he cares to, or any of the various lines in English; but, no matter what he does, he will have had a broad foundation in agriculture. Now, when he goes out to teach, be it in the common school or the high school, and no matter where he goes he knows the whole subject of agriculture as a foundation, and he can talk on dairying, he can talk on landscape gardening, he can talk on the question of veterinary medicine even; he can take up any line of horticulture; he has had modern languages; he has had, in short, the fundamentals of a good college training, and he has had an opportunity to specialize also. This plan gives the veterinarian a chance at the four-year man as well as the professor of agriculture, the horticulturist, the dairy instructor, and the instructor in forestry. They have the chance of interesting the student in their special lines as far as the 370 hours will allow. In many respects it is as valuable as a post-graduate course would be to some of our graduates.

It seems to me that if you give 150 hours in chemistry in the freshman year and 180 hours in the sophomore year, as allowed in the course outlined by the standing committee, by the time the students get ready to take up agriculture they have had an undue amount of chemistry and are not likely to care to pursue the subject of agriculture. It seems necessary to place all science on an equal footing. I think it is true we have stronger chemists to-day than we have men in other lines and that is the reason why chemistry is made so large a feature in these agricultural courses. Chemistry is one of the elementary sciences, however, the same as physics, zoology, botany, geology, etc., and should receive equal recognition at the outset.

Evening Session, Tuesday, November 14, 1905.

The section held a brief evening session to decide upon time of election of officers.

Afternoon Session, Wednesday, November 15, 1905.

The section was called to order by the chairman at 2 p. m.

Election of Members of Executive Committee and Officers of the Section.

Nominations for the executive committee being in order there were nominated W. O. Thompson, of Ohio; C. C. Thach, of Alabama; H. C. White, of Georgia; E. R. Nichols, of Kansas; L. H. Bailey, of New York, and J. L. Snyder, of Michgan. After considerable discussion as to method of voting, a blanket vote was taken and Messrs. White, Bailey, and Snyder, were declared elected.

C. R. Van Hise, of Wisconsin, was elected chairman of the section, and H. C. Price, of Ohio, secretary.

The president-elect and secretary-elect of the section were authorized to act as a committee on programme, with power to select another member, or members, if they so desired.

H. W. Tyler, of Massachusetts, presented the following paper:

WHAT IS A LIBERAL AND PRACTICAL EDUCATION FOR AN ENGINEER?

The life work of the engineer consists in the systematic application of natural forces and the systematic development of natural resources in the service of man. To be practical his education must fit him to do this most effectively. But the engineer is a man and a citizen before he is an engineer, therefore his education must also be liberal.

Our engineering colleges serve a people deeply interested in all forms of education, but particularly in the practical. Opportunities for primary and secondary education are everywhere abundant, but the quality of the work is variable, the organization of it is rather loose, and economy of time is rarely attained. As a result these colleges receive from the secondary schools every fall several thousand young men aged about 18, who have learned more or less algebra, geometry, English, and natural science, variously accompanied by Latin or modern languages, history, etc. They may or may not have learned to think logically, to observe accurately, to express themselves with clearness and force, to perform mental work with sustained concentration. If they have acquired any one of these accomplishments, we are grateful. Such is our material.

It is a well-established tradition that the course in the higher institution shall occupy four years of eight or nine months each. This is our time allowance.

In this space we must—

(1) Lay a solid foundation in mathematics and the natural or physical sciences, or both;

(2) Build a technical superstructure;

(3) Broaden and deepen and strengthen the student's faculties and character by instruction in the humanities—or, to follow the figure, we must help the student to make not merely his workshop, but his intellectual home.

The first is at once practical and liberal; the second is mainly practical, but need never be illiberal; the third is mainly liberal, but should never become unpractical.

An institution which neglects the foundation in science may be of great service, but it is only a technical school and should not be called a college; a college which is weak in the technical superstructure will attract the more ambitious students only for subsequent migration; a school of applied science which neglects the general for the professional education of undergraduate students will turn out narrow men whose professional careers will sooner or later be cramped by their personal limitations.

We are really attempting a short cut in education. The professions which were formerly called "learned" are based more or less generally on graduate study. In that part of the country with which I happen to be best acquainted this is apt to mean preparation for difficult college entrance examination at the age of 19, four years of diversion and study in variable proportions, then three years of hard work in the professional school, with self-support probable not much under 30. Highly as one may esteem this system and its products, the need of greater economy in time constitutes a more and more serious problem, for which means are eagerly sought.

For the engineers our institutions have boldly undertaken to solve the problem by combining the general and the professional, the practical and the liberal, in a single four-year curriculum. We welcome the bachelor of arts who seeks to secure our professional training in three years or even two. His education ought at the end of seven years or of six to be more broadly liberal than he could gain with us alone in four. But for many the plan has serious defects, and we do not for a moment admit that it would be profitable for engineering students generally to have become bachelors of arts first. The great majority of engineering students come, and so far ahead as the future can be estimated, will continue to come from the public high schools ready for four or five years of steady, earnest work, with the sustained incentive of professional interest.

It needs no excess of self-complacency for us to rejoice that the problem of belated graduation is one which engineering need not share with the older professions; but it behooves us not to underestimate the importance and the difficulty of our own corresponding problem—that of possibly premature specialization and graduation.

The question just how to combine our three ingredients, science, technology, and the humanities, confronts us even in the determination of our entrance requirements. How much shall we demand in mathematics, how much in physical science, how much in language and history? How shall we deal with the boy who is deficient in the latter, but is apparently qualified to succeed in an engineering course? While any answer of value must depend on local and personal conditions, I venture to say that in general it is useless to admit a candidate to an engineering college unless he can meet the mathematical requirements, that insistence upon the others may depend greatly upon the age and antecedents of the candidate, with due care not to admit students with too many conditions either for their own good or for the maintenance of standards in the collateral subjects in the preparatory schools and the colleges.

The distribution of time in the curriculum must represent the consistent working out of a logical educational theory. The student should be protected against the zeal of his teachers and his own enthusiasm by an arbitrary time limit on the amount of required work per term. The time available should then be apportioned with the utmost care among the various professional, semiprofessional, and nonprofessional subjects which seem on the whole most important and best adapted to the formation of a well-designed curriculum. The most attracive errors lie, I think, in the direction of overspecialization along technical lines. It is these which appeal most strongly to the immature student and often to the professional specialist as well. But the advantage which they may give the graduate is a short-lived one. Training in technical specialties may, if luckily chosen, stand him in good stead in five years; at the end of twenty-five years his degree of success will have depended far more on his education in fundamentals. This is the basis for one limitation of the " practical " element.

It is doubtless impossible to draw a definite boundary line between science and technology. The distinction is fundamentally a subjective one of point of view. Time was when the work of our engineering colleges was stigmatized as utilitarian and mercenary, and we must be always on our guard lest our students exaggerate the importance of immediate commercial applications of the facts and laws with which they are concerned. Our students have a natural and proper interest in their own personal welfare, but I would not for a moment admit that their whole interest in their scientific work is measured by this selfish motive. They choose their careers and their manner of education by reason of well-defined natural predilections. The utility of their studies, apart from mere personal profit, is an additional and not unworthy motive.

As to the detailed application of these principles to an actual curriculum, no college or individual may speak with authority. Each may learn something from the experience of every other. As one contribution to the subject I present an expression of opinion based on our efforts to solve the problem as it presents itself in Boston. We do not claim to have succeeded; we venture to hope we are working in the right direction.

All courses include modern languages, English literature, history, and economics. The time assigned to these is in general 27 per cent in the first two years, 17 per cent in the third year, making 18 per cent in the entire course.

This should not be understood as representing a curriculum of which 82 per cent is technical. While it is scarcely practicable to make a precise quantitative statement as to the distribution of time between general subjects on the one hand and professional on the other, I believe it is safe to say that in our own case the division would be not far from an equal one.

If I were to venture on a generalization, not intended to be in the least exclusive of others, I should be inclined to say that if a given curriculum gives half of the first year to science, including mathematics, a third to the humanities, and the remainder to drawing; if the professional work occupies one-third of the time in the second year, two-thirds in the third, and the whole in the fourth, and if the time remaining in the second and third years has been given somewhat more to science than to the humanities, the student will have fallen not far short of the golden mean of " a ilberal and practical education."

As to the distribution of time among the literary subjects, some freedom of choice may well be left to the student. He is apt to take less interest in work of this kind, and any interest he may have in a particular line should be thus fostered. The bearings of these general studies upon his scientific work should be made clear, but not unduly emphasized as the main aim. The real object is to develop mental faculties not effectively reached by other work. As a matter of course the engineer needs to be able to write his reports in good English, but this power is a small part of what the department of English may give him. His greater needs are to gain the most complete and correct appreciation he can of what the living world around him really is, of what it has been in the past, and of the relations to it of himself and his profession. He needs to know all he can learn of concrete human nature by association with his fellow-men, not alone his fellow-students, and then to pass beyond the bounds of possible personal experience into the regions of national and race experience in the light of history and economics. That study is most liberal which best liberates the mind from the limitations of ignorance, prejudice, and shortsightedness. The mind is expanded by the mastery of large ideas. It is narrowed by prolonged attention to the minute and the special. Modern science becomes more and more liberal in proportion as its subject-matter becomes systematized and coordinated by generalized laws. Such principles as the conservation of energy or natural selection are among the broadest and most liberalizing of human ideas. The engineer must occupy himself long and earnestly with details, but so, too, must the specialist in any line. The safeguard for each must lie in breadth and variety of interests.

In the comparatively short period since their foundation the engineering colleges have definitely achieved certain large results. They have gained the confidence of the industrial world by the proved efficiency of their graduates. They have won the respect of the great body of scientific men by resolutely insisting on thoroughness in scientific fundamentals as distinguished from empirical methods. They have still much to accomplish—as, indeed, have all colleges—in striving toward an ideal general education. This great problem is at once universal and individual. Every student is a special care. Every college must work out its own solution in a manner best adapted to its constituency as a whole and with as much freedom as practicable for the individual.

W. E. Stone, of Indiana, presented the following paper:

A Degree Course in Home Economics.

The extraordinary developments in scientific and technical education in recent years, in which the land-grant colleges have had so important a part, have played havoc with established notions as to curricula, degree requirements, and the relative provinces of the school, the college, and the university. The clamor against the recognition of the sciences, and, later, of the various branches of technology, as a legitimate part of a scheme of education has not yet subsided from our recollection, although no longer the subjects of serious controversy. Nowadays the student of systematic education is brought to contemplate a flood of new and strange subjects which have been injected into the curricula of schools and colleges with little preliminary digestion or correlation, and it is no wonder that one sometimes feels an honest doubt concerning the proper educational status of many kinds of instruction, of quite evident industrial application, but of remote connection with letters, arts, or sciences. From the nature of things, such examples are common in land-grant colleges which, in occupying the great fields of agriculture and the mechanic arts, have put forth a multitude of subjects for instruction in connection with the most commonplace and familiar operations of daily life, about which great numbers of people already possess some degree of knowledge and experience. It is inevitable that the right of many of these subjects to a place in the college curriculum, much less to weight in a course for an academic degree, should be questioned.

There are two phases or aspects of every art or industry, the operative, requiring manual skill, and the administrative, requiring a knowledge of and education in all of the subjects having relation to that particular art or industry. These manual operations are everywhere being constantly performed by uneducated people, with fairly acceptable results; they are not susceptible of great improvement or change, and even if they were so improved or changed they still would not require the services of highly educated operatives. Better training and greater intelligence on the part of such operatives is highly desirable, but the proper performance of these operations is not based upon an extensive knowledge of the sciences, but upon personal manual skill and experience. A certain training is desirable to prepare a boy or girl for these manual operations, and a certain other and much more comprehensive training is necessary for one who is to enter the administrative field. The one is included in our conception of the scope and purpose of manual training, trade schools, etc. The other involves the higher or professional education, and lies within the province of the college or professional school. It is not necessary or even desirable that all persons engaged in a given industry should have the same training, or that this training should be that comprehended in a college course. It follows, also, that the college, even though deeply concerned in industrial and scientific education, is not necessarily expected to train men and women in the elements thereof, any more than to include in its curriculum elementary instruction in mathematics or English. If this view is defensible, it may serve as a basis for distinguishing between those things which may or may not be considered worthy of a place in the curriculum leading to a degree in the land-grant colleges.

Personally, I am convinced that a subject which is administered solely in order to train the student to a greater degree of skill in manual operations can not consistently be included in a degree course. Examples of this kind may doubtless be found in many if not all of the land-grant colleges, but probably their sponsors would agree that these are matters of temporary expediency rather than permanent educational milestones. The question as to desirability of offering instruction in certain subjects in response to an evident need for useful training by the constituents of the college, is quite distinct from the question of what we should incorporate in a curriculum, every part of which is supposed to have weight in qualifying the student for a degree.

Public educational institutions, particularly those of such democratic character as the land-grant colleges, must give large heed to public needs. In recognition of this principle many of these colleges have been prompt to provide for their constituents instruction in a variety of subjects which were essentially manual training, and which in an ideal system of education would be relegated to secondary or even primary schools. The wisdom of this is not to be questioned. No phase of the development of agricultural education has been so well advised as the great tendency to popularize the work of the colleges, even to the extent of offering elementary instruction in college halls, but such a policy is to be approved only when it has for its ultimate purpose the broader education of the public to an appreciation of the needs for such instruction in its proper place, viz, in the elementary schools.

The Morrill Act specifies that the institutions of which it is the foundation shall be *colleges*. It behooves these institutions, therefore, to cherish college standards of scholarship, bearing in mind that the tendency in educational institutions of all grades is toward higher standards and more advanced curricula. If the land-grant colleges find it a good policy to engage in instruction in manual training, it should be for the sole reason that such instruction is not elsewhere available to its constituents. It should never, under any consideration, be regarded as a permanent part of a degree course. It would be far better, therefore, if in colleges where such subjects are offered, they were not made a part of a degree course at all, but turned over to that educational catch all the "short course:" the student in which finds his reward in the acquirement of knowledge alone without the accessories of sheepskins and degrees. It is, moreover, very doubtful whether colleges should undertake to administer such courses, even under these conditions, unless it is quite clear that the resources of the institution will permit so doing without detriment to the maintenance and development of instruction of college grade.

Degree courses in the land-grant colleges should be composed of scientific and cultural elements, and subjects which can not be shown to have some definite relation to such elements should have little or no weight therein. It is noteworthy that there are some subjects which may be classified, because of the *purpose* with which they are taught, as purely manual training; or, on the other hand, as illustrations of the sciences, with the study of which the student is engaged. For instance, shop work, planned and administered as an essential part of a course of instruction in engineering, in which it is desired to correlate all scientific knowledge of mechanisms, as regards their design, construction, operation, and efficiency, is entirely justifiable in being given a reasonable weight among the scientific elements of a degree course in engineering. But shop work, administered with no other purpose than to impart skill in the use of tools, does not belong there. Training a student to make butter simply as an industrial operation, would seem to be outside the province of a degree course, but practice in butter making as illustrative of certain scientific principles is, doubtless, properly included in a degree course in agriculture. Other examples might be given, wherein the purpose behind the administration of a given subject might be regarded as the sole reason for its retention in a degree course.

With this preliminary survey of the limitations of a degree course we may possibly obtain some clearer idea of the possibility of a degree course in household science. It is indicative of the confusion surrounding this subject that we have no general term for designating it. If, therefore, I refer to domestic science or household science or domestic economy or home economics or household economy or domestic art, as I may do indiscriminately, I mean always the same thing, viz, that field of activity, tacitly reserved for women, of feeding, clothing, nursing, sheltering, and entertaining their fellow human beings. It is a wide field beyond a doubt, and one amenable to the good offices of education of all kinds—general, technical, scientific, humanitarian, secular, religious, metaphysical, and material. Our homes are touched by all human learning, and the home maker and manager may well contemplate a broad training in preparation for all the duties and responsibilities pertaining thereto. From the educational standpoint the problem of training women for greater efficiency in the administration and execution of domestic affairs is comparable with that of training men for greater efficiency in the pursuit of farming. Both occupations are fundamentally related to the wellbeing of society; both engage the attention of great numbers of persons; both involve, in addition to manual skill, administrative ability of a high order; both involve the application of scientific principles to an unusual extent. In both we find the field already occupied by those without special education, who, in their own estimation at least, are achieving a satisfactory degree of success. As in farming, so in housekeeping there is a large amount of purely manual labor which must always be performed for small wages. Neither the character of this work nor the compensation received for it will justify a costly preparatory education. A fair degree of manual training is the most that can be expected to this end, and, indeed, is the best suited thereto. It is painfully evident that the social conditions in this country are already such that few of the native born are content to render manual service of any kind, much less to avail themselves of any systematic training for such a career.

Unfortunately for the good of society, as well as for the higher development of farming and domestic life, many are willing to boss and few to labor. To what extent our educational system is responsible for this it is impossible to say, but I am sure these conditions would be improved did our public schools concern themselves more with training children in industrial and manual operations in preparation for a career of activity which, naturally, the greater number of them will follow, and that our colleges should leave this field of instruction to the public schools and to the younger pupils therein.

In both farming and domestic affairs there are, therefore, the divisions of operation and of administration, the requirements for which are in each case quite distinct. While in many instances these two functions must be united in the same person, the decided tendency is to separate them. Preparation for the operative function is a matter of manual training and personal experience which ought to be aided by systematic school training. Preparation for the administrative side of farming or housekeeping means a wide knowledge of the sciences, arts, and letters, in general as well as in their application to the particular pursuit. This is the scope or field of degree courses as ordinarily administered in preparation for other lines of human activity, and it seems reasonable to expect a similar and consistent method in dealing with agriculture and household occupations.

Engineering colleges concern themselves only incidentally with instruction in manual operations in degree courses. They do not seek to train mechanics or artisans, but rather to train men who shall plan and administer the work which is to be performed by such. The agricultural colleges are approaching a like standard as to their degree courses, although the stage of the art and the present development of agricultural education will scarcely permit, as yet, curricula which, even in the most advanced institutions, are free from subjects of manual training character, although in the main their degree courses are composed of scientific and cultural elements.

Domestic science, as compared with agriculture or the mechanic arts, is still in the early stages of development as a field for educational effort. The situation is quite like that which existed in agricultural education in its early days, except that now the public mind is better informed as to the possibilities of technical training, and, consequently, is inclined to receive new propositions with greater sympathy and interest.

But what shall be taught under the head of domestic science; how shall it be taught; what shall be the sequence of subjects; where shall they be presented? These are all questions about which no two persons have the same opinion, and when it comes to the matter of a college course leading to a dergee in this subject it is pertinent to inquire if at the present time such a course is feasible, justifiable, or educationally wise.

It must be quite evident to every thinking person that the art of directing a household is one highly susceptible to the benefits of training and education; that a wise application of scientific principles to household management can not fail to result in better health, greater economy and happiness, and a higher plane of living, and that these conditions, in time, have their beneficent influence upon society in general. Not only can we understand these possibilities, but we can well believe the statements of those informed in such matters, to the effect that the social and moral reforms so greatly needed in certain classes are best promoted through better conditions of home life, to be gained by education and training of the most elementary sort.

It is impossible, therefore, to overlook the importance of the field, and the opportunity here afforded for an educational work of the widest scope, extending from the simplest manual training to the highest applications of learning of all kinds to a more rational development of domestic life and the home.

There is no doubt that the actual needs in this field are far beyond the capacity of existing educational facilities as they exist now or are likely to exist for a long time to come.

We shall agree that any girl who is a potential home maker should have an educational preparation for this important function, and that the elementary phases of this training should receive quite as early and weighty attention as any other. Few mothers are competent or able to do this work, and the source of this training must be found in the public schools, where all girls should have some good instruction in the manual operations of the household, such as cooking, sewing, the laundry, and the principles of sanitation and hygiene.

Nine-tenths of these girls can never obtain any education beyond the public schools. The few who can go to college can not afford to spend valuable time there in elementary and manual operations, neither can the college afford to spend its resources in doing what is more appropriately done in the elementary schools. But for the college girl there is possible a superior training for the higher duties of the home, which will be to her of far greater value than the average college curriculum, and which will have in it no whit less of disciplinary and cultural value. This training should range over the field of science, arts, and letters, bearing upon the physical, social, and moral problems and functions of the home, and should lead to a degree of equal significance with those granted in other scientific courses, as, for example, in engineering or agriculture.

It seems quite clear to me that the field of effort comprised in the term "home economics" is of such potential significance as to deserve recognition throughout the entire educational system, beginning with the primary school and ending with the university. As in the case of agriculture, the first steps of educational development in this field may most wisely be devoted to the elementary and manual training for young girls in the public schools. If public sentiment is not yet ripe for the introduction of these subjects into the public schools, it may, after all, be the wise course for the land-grant colleges—as leaders in molding popular views regarding technical and industrial education—to administer these primary courses temporarily, provided the public be made clearly to understand the reasons for so doing. Growing out of and in extension of these, there will follow in due time a legitimate course of study of collegiate character, in which cooking, sewing, laundering, etc., will have no place, but in which there will be thorough study of the natural sciences, with a generous allowance for the liberal arts, and for which the degree of bachelor of science may consistently be given.

Apparently such popular demand for instruction in household science as exists at present is chiefly for the elementary features, or at least for courses in which these have a considerable part. It is probable that strictly scientific and cultural courses, such as I have intimated should be required for a degree, will be but sparingly attended. Young women who attend college seem to prefer courses in liberal arts to those in science, and this attitude will continue until there is developed a popular knowledge of and appreciation for the art of doing things properly and well, and a pride and joy in work for its own sake. There must first come a general understanding of the value of this kind of education and a keener realization of its need before it will be popular with young women. This attitude of the public will best be developed by improving the elementary and manual training instruction in the public schools, since this reaches and influences the largest number of people, and yields the most tangible and the greatest results.

The land-grant colleges seem destined to have a large share in this development, and therefore have a large responsibility, which is not in the direction of aiding and encouraging this new education alone. They are in quite as great a degree responsible to the educational world for maintaining educational standards. A degree course in home economics will be entirely consistent with such standards if given for thorough work in the liberal arts and sciences as applied to domestic problems, but not if given for training in the manual operations of the household.

J. L. Snyder, of Michigan, presented the following paper:

WHAT OUGHT A DEGREE COURSE IN HOME ECONOMICS TO INCLUDE?

The true object of all education is to prepare for life. This preparation may bring the recipient into harmony with his environment, or it may develop in him sufficient power to create entirely new environments. It may be confined to the accumulation of knowledge, and the memory may be used as a case of pigeonholes, in which are stored selected data to be brought forth as occasion may demand, or it may be so directed as to develop power. Knowledge and power—the latter word used in a general sense—were at one time held as the chief and only objects of a higher education. In later years higher education has been called upon to perform another function, not only to give knowledge and power, but also such special training as will prepare the recipient for one particular field of labor. Education adapted to one particular end is commonly termed technical education. A degree course stands for a certain amount of culture and mental training. A technical course leading to a degree must in addition to the necessary technical subjects contain also such other subjects as will give a considerable degree of culture. Many technical subjects based upon previous training in science give mental discipline. This is specially true when pursued in the scientific spirit; other technical subjects train the hand and the eye, but afford little means for mental training.

A course in "home economics" is designed to give such training as will best fit the recipient for administering the duties of the home. These duties are many. To meet them intelligently a woman must not only be skilled in the selection and preparation of foods and clothing, but she must have all those other qualities of mind and soul which find their fullest fruition in her life as a companion, as a teacher, as a mother. Preparation for these duties requires much broader training than that usually given in technical courses. It is only recently that it has been thought advisable to give young women such training as would fit them specially for the vocation in life which the great majority of them are destined to follow and which the minority would no doubt gladly follow if they could enter upon such a vocation under circumstances satisfactory to themselves. While the progress of developing courses of study in home economics has been very rapid, such courses are still in the early stages of development. Yet considerable knowledge of a practical nature has been organized and worked out in pedagogical form and is given to a large body of young women with very satisfactory results.

The question, however, is, What ought a degree course in home economics to include?

First, it should be a four-year course and should be preceded by a thorough and strong preparatory course, not less in either quantity or quality than that required by all good colleges and universities for entrance to the freshman class of all degree courses. This preparation is fairly represented in the four-year courses given in our best secondary schools.

To correspond in a measure with other technical courses leading to a degree, about 20 per cent of the work of the freshman year should be purely technical; 33 per cent of the sophomore year, 40 per cent of the junior year, and at least 75 per cent of the senior year should be technical. This course should contain such studies as are of recognized exceptional worth for all courses. Higher algebra and solid geometry should be reviewed and electives offered in trigonometry, analytical geometry, and calculus. English should be given a very important place, and should include thorough courses in composition, rhetoric, voice culture, English and American literature, dramatic interpretation, orations, etc. Several courses should be offered in European history and political science. At least two years in a modern language should supplement that already taken in the preparatory course. A two-hour course in ethics should be given during the first term of the freshman year. This gives the dean or some other person of age and experience an opportunity to have heart-to-heart talks with the new young women concerning college ideals and other subjects such as young women away from home for the first time should receive light upon. Every young woman upon entering college should be given a careful physical examination and a system of gymnasium work prescribed, suited as far as possible to her individual needs. Physical training should extend throughout the course.

Music is certainly very desirable, if not really necessary, in the home. Hence, this course should offer at least two years of instruction on the piano, without extra charge, and also some opportunity for training in vocal music.

Drawing should be given a prominent place. Courses should be given in free-hand and charcoal work, to be followed by a short course in mechanical drawing, which would be given as preparatory to courses in woodwork and in landscape architecture. This work in drawing should be followed by a course in the graphic arts and also a course in the history of art. The backbone of the course, however, should be science and its application to household affairs. Physiology, hygiene, and anatomy should be thoroughly studied.

Botany should include courses in fruit and seeds, taxonomy, trees and shrubs, histology with elective courses in physiological botany, and advanced work in histology.

This study would prepare the student well for the work to follow in horticulture, landscape gardening, floriculture, and elective work in pomology, floriculture, and experimental work.

The course in elementary chemistry would be followed by courses in analytical, organic, and what might be termed in lieu of a better term, domestic science chemistry. The latter course would include the study of foods by quantitative methods, determination of the heat energy of various food materials, the sanitary analysis of water, etc.

Thorough courses in zoology should be given.

Instruction in physics, including laboratory work, should be given in sound, light, heat, and electricty, as well as some advanced work. Special emphasis should be given to ventilation and such other problems as relate to the home.

As bacteriology is a comparatively new department of science and one which is destined to play an important part in home economics, it might be profitable to consider briefly its value both as a disciplinary and as a practical subject.

The cultural side of bacteriology offers the following points: (1) It is soon learned from the study of bacteriology, that abstract mental deductions, founded upon the usual logical sequence, are by no means infallible, and, further, that what the human mind frequently suspects, based upon facts already at hand, may be diametrically opposite to what really exists; in other words, speculation and abstract reasoning are accepted in philosophy, but are ever prone to be erroneous in nature's studies. (2) The imagination is trained by bacteriological studies in following out natural processes instituted by invisible agents. Under such circumstances, what the imagination furnishes is checked eventually by the study of the real forces. (3) Accuracy is secured and delicacy of touch, through bacteriological laboratory manipulation. (4) A broader and more comprehensive view of life distribution is secured. (5) It becomes possible, through the study of micro-organisms, to gain an intimate knowledge of life structures and functions which can not be obtained by confining oneself to more complex life forms. (6) Many of the natural forces which have been mysterious to the student become real and significant by an acquaintance with the acts of micro-organisms.

From the utilitarian standpoint may be added:

(1) It is very desirable to know something of the contagious and infectious diseases, their propagation, dissemination, and control.

(2) It is highly desirable to be familiar with disinfection in all its phases.

(3) Some acquaintance should be had of the antiseptic treatment of wounds, of aseptic surgery, and of obstetrical practices.

(4) Every person should know something concerning food poisoning, due to toxins and ptomaines, and everyone interested in food should know something concerning its preservation in the form of canning, preserving, and drying.

(5) A knowledge of our water supplies and the relation to diseases should be understood.

(6) Likewise, sewage disposal should not be omitted.

(7) Home knowledge should consist, in part, of a familiarity with fermentations, as represented in milk, vinegar, and other substances, and putrefaction and decay should be thoroughly understood.

Many other topics commonly taught and practiced in bacteriology are of equal importance with the ones named. A course in bacteriology which should provide sufficient knowledge and training to equip students in home science requires at least one year of two hours each day given to the science. Of this, there should be two lectures each week, and eight hours of laboratory work every week throughout the year. Less time will not furnish necessary training to make the subject useful in everyday life, for its usefulness represents its greatest value, and scarcely a day passes in one's life in which one can not make use of it.

There should be given under the misnomer "domestic art," practical courses in all phases of needlework, beginning with sewing in its simplest form and leading to healthful and appropriate wearing apparel and to the decoration of the home. This would include plain sewing, dressmaking, hand sewing, art needlework, millinery, the study of textiles, and house decoration.

Women do not know how to keep house by instinct. Practical arts are learned by practice. This work, with the practical courses in cookery, would bear much the same relation to a course in home economics that shopwork bears to courses in mechanical engineering.

Under the head of "domestic science," which is another misnomer, should be given such instruction as would make the students familiar with the best and most economical methods of homemaking and housekeeping. The common facts of science should be correlated in their bearing upon household matters. The various methods of conducting a home in comfort and health should be discussed and the most important of these demonstrated practically. The course should include at least laboratory work in general cookery, cooking for the sick, waitress work, and advanced cookery.

Principles of cooking, with practical individual work, should include handling large and small quantities of materials. All elementary methods of cooking should be taken up and dealt with thoroughly—food value, cost, preparation, and cooking of vegetables, cereals, meats, etc. The lessons should be arranged in logical order and each principle illustrated by the preparation of simple dishes.

Lectures should be given on the various scientific principles which are necessary as a foundation for an intelligent understanding of the science of cookery. Then should be taken up the subject of foods, their composition, growth, history, preparation, and the manner in which they are affected by cooking, also a classification of foods, and the making of dietaries should be studied at some length.

This should be followed by a course in invalid cookery and also courses in advanced cookery.

Thorough instruction should be given in the serving of meals, care of rooms and furniture, cleansing agents, and laundry work.

The business side of home life should not be neglected. Instruction should be given as to business forms, simple cashbook as adapted to household accounts, notes, drafts, and other forms of commercial paper, monthly and yearly statement of expenses as compared with the ideal division of income as recommended by political scientists.

Courses should also be given in house architecture, emergencies and home nursing, sanitary science, and dietetics.

The amount of practical or technical instruction is limited only in time and teacher. The foregoing indicates in a rather indefinite way the amount and character of work recommended for a four-year college course at the present time. It is in fact the work offered in the women's course of the college with which the writer is connected. Courses in home economics are new and naturally very defective. They have been thrown together very often without much regard for the logical sequence of studies. Their nomenclature is little short of ridiculous, yet progress has been rapid and substantial, and in a very few years courses in home economics will be as clearly defined, as logically arranged, and as inspiring and helpful as technical courses in agriculture or engineering are at the present time.

The technical instruction will bear, in time and character, about the same relation to the culture studies of the course as the technical instruction of old and recognized technical courses bears to literary studies.

The question will naturally arise, Should such a course be crowned with the bachelor's degree? The answer to this question will depend somewhat on the spirit in which the work is pursued. If the object is simply to make a good cook or good housekeeper the propriety of granting a degree might be questioned. On the other hand, if all the work in literary language, history, science, and its application to the home is given in the spirit of investigation and the atmosphere of freedom the result in mental attainments and culture should be such as to lead to the bachelor's degree. Much of the technical work offered if properly taught will give mental training of no inferior quality. The cooking laboratory should be used as far as possible to illustrate and fix in the mind scientific principles.

The amount of mental training derived from any laboratory exercise depends very largely on the teacher. The work may be perfunctory and mechanical or it may be bristling with new problems, the proper solution of which will compel the student not only to recall past instruction, but to devise some original method by which to obtain desired results.

The course as outlined in charge of good teachers with proper laboratory facilities will give the students (1) mental development, (2) scholarly methods of work, (3) the scholar's working equipment, and (4) ability to meet with confidence and conquer the everyday problems of life.

TO WHAT EXTENT SHOULD THE DEGREES IN LAND-GRANT COLLEGES BE SEVERELY TECHNICAL AND SCIENTIFIC?

L. H. Bailey, of New York, spoke as follows on this subject:

It is certainly very difficult, after hearing so many papers touching upon this subject in so many ways, extending over a period of two days, to pick out any particular theme for discussion or comment. I think I have never listened to a series of papers which so fully cover the ground and which discuss the question so acceptably from two points, the theory of education and the actual practice in the different colleges with which these persons are engaged. Certain general considerations, however, have crystallized themselves in my mind as I have heard these discussions. If I were to make any particular statement the text for the remarks I am now to make, I think I would choose a certain sentence which was uttered by President Stone this afternoon—the statement that the industrial education, or the education of the land-grant colleges, had played sad havoc with the curricula. It may be well to ask, very briefly, why the work of the land-grant colleges has played sad havoc with the curricula. It is very evident from the discussions of the last two days that we have broken away from the idea of following exactly the text of the land-grant act—that is, we conceive the land-grant act to represent the purpose or intention of the education which it founded, rather than to set forth the method of instruction or the conduct of the institutions founded upon the grant.

Now, the land-grant education has not followed academic methods very closely, because the land-grant education was, and in fact now is, a revolt from the type of education which was then chiefly in existence. But there are specific reasons why the land-grant curricula have played havoc with the older courses. In the first place, the purpose of the land-grant idea of education is democratic rather than aristocratic. It is not conventional or traditional education. Its very purpose and idea is to reach all persons in the terms of their daily lives, and the terms of the daily life are very largely expressed, or were, at least, in 1862, in agricultural and mechanical arts.

In the second place, this industrial education reaches a new economic and social constituency. This constituency comprises persons who are not much given to assemblages and to organization, persons in whom the idea of individualism is very strongly developed (particularly on the agricultural side of the work of these institutions), persons, therefore, who do not go to college, but who have the desire to have the information brought to their doors.

In the third place, the necessity has been forced on the land-grant colleges of doing a great deal of secondary school work. They have been obliged to do much that is not college work, at least not in the old sense. We are gradually freeing ourselves from that necessity, as the common schools are teaching more science and more technical work and are fitting pupils better for entrance into real college work in agricultural and mechanical colleges.

In the fourth place, this whole land-grant college enterprise has been seized with the missionary spirit, it has been thoroughly democratized, and the effort is being made to carry it to the homes of the people by means of extension propaganda. Extension work is coming to be an important part of the work of the colleges, although it is not perhaps a part of the curriculum, but it has modified the character of the course work that is done in these institutions. I look upon the winter courses and short courses in agricultural colleges as purely extensional. I do not regard them as college work.

I lament the fact that it is so necessary for the agricultural colleges to hold short courses. It is necessary, however, because there are no other institutions in which that kind of work can be done. Speaking of our own case, I may say that we organized a winter course at Cornell University some ten years ago, supported by university funds. But there came a time when certain funds were given by the State for extension work. It seemed perfectly legitimate, as it was necessary, to maintain the winter courses on the extension fund, and they have been so maintained. The winter courses at our college of agriculture have no relation to the regular academic work of the college. At the present time they do have relation, so far as the teaching force is concerned, but if our plans hold we shall soon have a separate faculty for the extension work, including the winter course and some other extensional work.

I was very much impressed with the increasing confidence with which the different speakers dwelt upon the value of agricultural and mechanical education, showing that it has acquired a permanent place in the educational policies of the country.

There are several ways in which the general drift of this discussion possibly might be expressed. I note that all the speakers insist on the general pedagogical value of applied and technical subjects when these subjects are well taught. They regard these subjects as of equal training value with conventional subjects, provided the teaching is equally well done. On the other hand, there seemed to be a tendency to urge the introduction of many new subjects into the curriculum merely because they would find a place in the subsequent life of the person. I am somewhat inclined to challenge this point of view, for I conceive that the primary purpose of introducing any subject is its training and educative value and its power to put the pupil into sympathy with his environment. It may or it may not be worth while to introduce a subject merely because it is needed as a part of a livelihood.

Again, there is a marked tendency to react from the exclusively or specially technical undergraduate courses and to hold somewhat closer to some of the traditions of education. I think that the general tenor of these discussions enforces this remark. We are now considering a middle course, it seems to me, between the exclusively professional work of these colleges and the traditional or conventional education. If we can not teach everything, neither can we afford to break with experience, and the question is how much of the new we shall combine with something of the old. Through the papers there seems to run a sentiment that training for mere manual skill should be eliminated from courses that lead to degrees. This you will recall is very forcibly expressed in the change of attitude in the agricultural colleges during the last twenty years in respect to compulsory manual labor. All of them have now given it up, and the labor now required in the agricultural colleges is on an educational basis, namely, laboratory work. The growing disposition to occupy the first two years of a college course with fundamental, or what some people wish to call "pure science" subjects, is a further indication that mere technical training is insufficient.

I was much interested in the chart presented yesterday by Professor Rane, in which he tried to put back the fundamental courses in the first two years of the agricultural course. I fully sympathize with that idea, and I think all the speakers have given suggestions along the same line. It may be worth while to speak of the disposition of the horticultural courses at Cornell University, inasmuch as they were mentioned by Professor Rane. You will recall that certain institutions were compared with respect to the horticultural courses Every one of these institutions except Cornell University requires horticulture as part of the four-year course. I have had something to do with horticulture at Cornell in the past years. There was a regulation at one time that all students graduating in the college of agriculture should have had a certain amount of horticulture. At my instance that obligation was removed.

I felt that the first two years of the course should be given to fundamental courses, and that in the third and fourth years a man might have the privilege of specializing in dairy work or horticultural work, as the case might be. I did not agree with Professor Rane's idea that some technical horticulture and dairying should be required in the early course and that a man graduated in that course should be well fitted for taking up one or more of these professions if the necessity should arise. I would rather think that he should be exceedingly well prepared to take up one occupation. I am not quite sure whether in the future we shall have departments of horticulture. I rather think that we shall not; that is, on the lines on which they are now organized. Horticulture as now outlined in the institutions of the country is very largely an occupational subject rather than a pedagogical subject. I would like to see all colleges require, for example, a course in plant propagation, which should be in some way related to botany. I think that the fundamental plant-growing subjects should be a part of the botanical or similar courses in the early part of a four-year course of instruction.

The drift of opinion seems to show that there is a general harmonizing of the conduct of the courses of instruction in all the land-grant institutions, and a determination, even in the midst of the many new subjects which are clamoring for admission, to teach what are really the fundamentals. I think the tendency in our land-grant colleges, as also in the secondary schools, is going to be to simplify rather than to add more.

Again, there is an increasing sympathy with the workaday life. There is an increased desire, nevertheless, to introduce other subjects that have relation to the everyday lives of the people, but they can be so treated as not to conflict with the other subjects, but rather to aid and complement them. It seems to me that these discussions indicate that the land-grant colleges are becoming a concrete expression of democratic ideas.

The home-making subjects are dwelt on in some of the papers. The reason for these courses is not the specific occupations for women; the home is the center and the reason. The various speakers have mentioned the difficulty of securing a name for a course covering these subjects. I have challenged them all. Temporarily I use the words "home economics" as perhaps broader than most others and having less objectional connotations. I like to think of the course of home economics as comprising more than housekeeping subjects, larger than "domestic science," as that term is commonly used. We have been trying to increase the productivity of the land; we have not emphasized the value of the home as an entity. It is time that we emphasize the home, study it in relation to the community, to the school, to the church, to organization, and to all the large economic features which have to do with the relation of the home to the general welfare.

The general drift of this discussion shows that the land-grant colleges, particularly on the agricultural side, do not regard the courses as professional or at least not as severely technical. And if that is true, I think it means a very great gain for agricultural education. This education is industrial in a broad sense. It is natural education, and is founded on general pedagogical principles and methods. I am coming to like the phrase "education for country life" instead of "agricultural education." The idea no longer stands for technical agricultural instruction alone. It stands also for all the social and economic relations of the farm to its community. It stands for the discussion of the rural church, the rural school, rural literature, sanitation, good houses, good roads, organization, and all the laws that govern trade in farm products. So I like to think that the agricultural college now stands for the open country in its largest and broadest sense. Possibly we feel this more forcibly in the East from the fact that the cities are so exceedingly important in our old Commonwealths. For example, in New York State there are 8,000,000 persons, about 1,000,000 of whom are on the farms. Therefore the character of instruction which we are called upon to give may be somewhat different from that which colleges in the corn-belt States find to be best, where perhaps half of the persons are on the land or directly connected with it.

I was very much impressed with the fact that the papers emphasize the pedagogical ideas more than they would have done a few years ago. This means, of course, that we are looking on the courses of agriculture and mechanic arts as courses having training capabilities as well as fitting for a distinct occupation in life.

There is another feature of the work at the agricultural colleges which has not been mentioned. It is spirit. I can conceive of an institution with no agriculture in its curriculum which still teaches good agriculture; and, conversely, ever so good a curriculum will not make an agricultural college. Good spirit is half of a college course. Perhaps it would be better to say that no college course is worth the while without this enthusiasm and fullheartedness. I would think any agricultural college quite remiss if it did not somewhere and at some time take upon itself the responsibility of calling its students together for the purpose of general intercourse or general reading, or for lectures and discussions of large questions which are not directly agricultural. I like to think of the agricultural student as a man who has the roots of his affection founded in the traditions and experiences of the human race as expressed in literature as well as in the distinct industrial vocations in which he is engaged. A great deal can be done in training men's minds and directing them wholly outside of any curriculum which may be put on paper. I am sure that every one of us feels that there are possibilities in the administration of a college of agriculture for educational uplift and spiritual enthusiasm wholly outside of the curriculum in the college catalogue.

Hon. William T. Harris, U. S. Commissioner of Education, being introduced, spoke as follows:

ADDRESS OF HON. WILLIAM T. HARRIS, UNITED STATES COMMISSIONER OF EDUCATION.

Mr. Chairman and gentlemen, I had the honor to make some remarks this morning in the general session relating to the vestibule of education, meaning by that the preparatory studies which furnish a common basis for higher education, and especially for that part of the higher education which specializes its studies. I will confine my remarks now to the relation which the specialized subjects in agricultural and mechanical training have to the common preparatory branches which belong to the vestibule of the temple of learning. We have a law of Congress which provides an endowment for the agricultural and mechanical colleges of $25,000 each, and which provides specifically that the benefits of said annual endowment shall be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, and to the facilities for such instruction. The omissions in this list are very important and suggestive. One will notice an absence of branches relating to other languages than English, and especially to the omission of the so-called classics, Latin and Greek. It had happened before in the State institutions which arose on the foundation of the endowment of 1862 for the establishment of colleges for the benefit of agriculture and mechanic arts that older institutions, modeled on the basis of the college or university for general culture, had obtained the advantages of said endowment, and not being limited in their application of the fund had used it for the most part in strengthening what I have called the vestibule to education—the general preparation for higher studies. Inasmuch as the students seeking general culture were far more numerous than those who had marked out for themselves careers in special industrial studies, it had come to pass that nearly all of the benefits of the agricultural and mechanical endowment had been applied to the branches which underlie common culture, namely, foreign languages and especially the so-called "dead languages," Latin and Greek, and to modern languages. The new endowment of August, 1890, therefore, provided in a careful manner that its proceeds should not go toward strengthening the foundations of education, but should be applied entirely to the superstructure of the special education intended for agriculture and mechanic arts.

It should be said at this point that application of the earlier endowment, that of 1862, in such lines as had already been fixed in the older college education was necessary, partly because there had as yet not been formulated, or at least not yet published, any systematic and well-graded course of instruction in agriculture or the mechanic arts. There being comparatively little experience in this field and only feeble attempts to reduce it to a course of study, the directors of higher institutions found themselves in the presence of a formidable difficulty in carrying out the obvious intentions of the first endowment, that of 1862. In the meantime nearly thirty years of experiments in collecting and systematizing a body of doctrine relating to agriculture, as it is found in the United States and elsewhere, had elapsed. The time had arrived, therefore, in 1890, when a new endowment could be guarded in its applications and directed toward the specialties of agriculture and the mechanic arts, and its application to instruction in ancient and modern languages entirely prevented. Nothing of this new endowment should go to the traditional foundation studies, to higher education, with the exception of mathematics. The history of the application of the first endowment, that of 1862, had shown conclusively that no superstructure would arise on those foundation studies, and that the endowment for agriculture and the mechanic arts would only go so far as to furnish a vestibule to all kinds of higher education, and especially to education for the learned professions.

Of course all these things could not have happened unless suggested or at least permitted by current public opinion. Nine out of ten persons desired a general foundation for higher education instead of instruction in specialites relating to agriculture and the mechanic arts. There had been very few examples of learned men in those specialties in this country to attract young men into agricultural and engineering careers.

In the history of the United States since 1862 one of the noteworthy lines of progress relates to mining, another one to railroad building, another one to the manifold uses of electricity, and still another to the progress in organic chemistry and the application of inorganic chemistry to various other industries. It has been an era of the unfolding of engineering in manifold directions for the conquest of matter and force in the service of man.

In the meantime free public high schools have been founded, mostly at the expense of municipalities, all over the United States, and the elementary beginnings which belong especially to what I have called the vestibule of education have been provided abundantly. But opportunities for pursuing long courses of study in special branches of industry have not been furnished so generously for the youth who have completed their preparatory studies and who have adopted for themselves careers which demand long periods of original investigation, under distinguished experts, with access to well-equipped laboratories.

Meanwhile the agricultural and mechanical college as it has been has slowly built up a body of doctrine in its specialty and has obtained a sufficient survey of its course to outline for itself without any serious error the course of future progress in enlarging the scope of its instruction and in perfecting its methods of investigation.

Many agricultural colleges are represented here in this audience by professors who have done distinguished work in reducing various branches of their work to a better pedagogical form. A branch is reduced to a pedagogical form when it can be taught in a series of lessons, of which the first lesson is useful if none follow, and the first two, or first five, or first ten develop each lesson out of the next preceding one, partly unfolding the consequences of what precedes and partly explaining the grounds of what precedes. Good pedagogical form makes possible systematic instruction in the school.

My thoughts have lately been directed toward the relation in which the advanced specialized higher studies stand to the body of preparatory branches. In what way are those early studies in the high schools and in the freshman classes of colleges and universities related to progress in the mastery of science and to the original investigations which advance science itself and make possible its applications to industry. I will limit myself especially to the old question which has so many times been thrashed out regarding the use of certain kinds of language study as an essential preparation for the several sciences of nature.

The interesting and suggestive course of study in horticulture, which is mapped out and exhibited on the walls of this room, furnishes me a text. I notice the words "agronomy, zootechny, agrotechny, rural economy, rural engineering, apiculture, viticulture, pomology, olericulture, floriculture, horticulture, botany, zoology, meteorology, mathematics, geology, physiography, biology, bacteriology, entomology, veterinary science, agrostology, embryology, cryptogamic botany, vegetable cytology." This course of study before us and the courses of study published in the catalogues of the institutions founded on these two endowments of Congress go to prove that Latin and Greek are not dead languages, as they were supposed to be, but are languages that are quite alive in science and the arts. Even in agriculture the sciences have borrowed words both from the Latin and from the Greek in order to arrive at a perfect accuracy of expression. Colloquial words of Anglo-Saxon roots are well enough to express ordinary experience, but not at all adapted to the expression of the results of precise and systematic investigation. There are two vocabularies in a language—the colloquial vocabulary and the vocabulary for science, literature, and philosophy. Everybody uses the colloquial vocabulary in common, but only those who are specially educated in the branches of a higher education can use intelligently the second vocabulary. Ordinary colloquial discourse is well enough in its way, but it is only a beginning of language. Its objects are simple and undefined and on the whole shallow as to thought. The word "knowledge," for instance, expresses in one word all sorts of information and reflection. It is a great, undifferentiated heap of results of acts of knowing, while science—expressed by the Latin word scientia—expresses a systematic organization of facts in such a way that each fact throws light on all the others. Knowledge is for the most part a heap of isolated, undigested particulars of perception and reflection, mere shallow facts mixed with more or less profound observations of all kinds. Science, in the first place, classifies its facts and brings together those which throw light on one another into one branch of science. Then it connects these systematically, so as to show their order of genesis from the first to the last. The difference between a dumping heap, where all sorts of things that are of no use are piled in confusion, and a regular and symmetrical piece of architecture is something like the difference between knowledge and science.

This is preliminary to the answer of the question, What kind of language study aids in the mastery of natural science? One can not help thinking as he looks over the names of the divisions in the scientific course of agriculture, or in mathematics, or physics and chemistry, or geology and geography that the pupil's time must be taken up, in the higher special courses of study, in memorizing technical words of many syllables, unless the pupil has in his earlier preparation made the elements of those words significant. If the student has learned Greek in his preparatory years, the word "agronomy" divides out for him at first sight into the roots of the word "agros," a field, and the word "nomos," signifying a usage or a principle of management; "agriculture" suggests the Latin word "ager," a field, and "cultus," from "colere," to sow or plant. A knowledge of the meaning of the parts of a word is a powerful aid to the understanding of the meaning of the whole word and to the retaining of the same in the memory. Thousands and thousands of technical terms occur in botany, all founded more or less on Latin words. A superficial study of Latin will increase the power of comprehending the scientific technique of botany. As long as one does not know the language from which the technical terms are derived, he is forced to make a greater effort to remember them and a greater effort of mere mechanical memory without thought. Compare the difference to the ordinary college-educated man between a term derived from the Sanskrit and a term derived from Latin: "Magnanimous" can easily be understood by the Latin student on recalling the word "magnus," great, and "animus," the soul or mind; the word used in the Bhagavad Gita, "mahatma," frequently used by students of the so-called esoteric Buddhism, is difficult to remember unless one has the same elementary knowledge of Sanskrit, in which case he recognizes the first part "maha" as meaning great and equivalent to "magnus," and "atma," the soul; or take maharshi, which is "maha," great, and "rishi," a sage or wise man. Take also the geographical name of the country at the mouth of the Indus River in India; the territory is called Punjab. The person superficially acquainted with Sanskrit recognizes the first part of the word, "punj," as meaning five, and "ab" as meaning river. The Punjab is the delta land between the five rivers or branches of the Indus at its mouth. An elementary knowledge of Latin and Greek gives one the power of retaining and of comprehending technical terms with a fine sense as to the shades of meaning. It is a matter of every-day experience to see students not acquainted with Latin make a mistake in spelling or in identifying the parts of a long technical word, and, what is worse, a mistake in getting hold of the shade of meaning indicated.

This brings us to the insight that Latin and Greek are very far from being "dead languages." No longer used colloquially for simple conversational speech, they are all the more used for preserving the results of scientific observation and for literary expression of fine shades of feeling and distinctions of thought, and it is very necessary to get the elementary significations of the Latin and Greek roots, which one does in his three years' high school study of Latin, in order to acquire a fine sense of the use of these words in scientific technique. It also makes the technical vocabulary as easy to remember as the colloquial vocabulary. The word "carnivorous," for instance, has the root "carn" and the root "vor," "carnis" meaning flesh and the root "vor" to eat or devour, the whole word meaning flesh eating. The lack of a feeling of the original meaning of these words produces the ludicrous use of language caricatured by Shillaber in his "Sayings of Mrs. Partington." Mrs. Partington is a type of the person who has no adequate sense of the original meaning of the classical derivatives which he uses. Uneducated colored people often furnish examples of speech of this kind. One of them, for instance, goes to a drug store and asks for a "nanny goat" for a particular poison, meaning "antidote." And Mrs. Partington thought that "total depravity was a very good doctrine if you could only live up to it." The Greek meaning of the word "antidote" is just as easy to remember as the name of the domestic animal to a person with a smattering of Greek, and the Latin meanings of "total" and "depravity" are equally easy to the one who has given some study to Latin.

The fact that what is called a complete English dictionary contains three Latin or Greek derivatives to one word from a Gothic source shows us that to the educated man the livest part of his language, so far as science and literature and the higher order of thoughts are concerned, is the Latin and Greek contingent. Any person who had to learn botany or chemistry would find it worth his while to begin by a three years' study of Latin and Greek just for the benefit of these languages in his scientific education. So, too, for history or for poetry, and by far more essential for medicine, the law, and divinity.

I admit that there is abuse of time and energy in studying Latin according to the favorite methods pursued in preparatory schools and colleges. I had a poet friend, a chum of mine at Phillips Academy, Andover, in the times of Samuel H. Taylor, the Greek scholar. Meeting him at a reunion of our class after many years, I asked him, "What did you learn at Andover, and what did our class learn?" He replied, "We learned the exceptions. To be sure, we learned the paradigms; but that did not take much of our time." It was the committing to memory of lists of unfamiliar words which were said to be exceptions to the regular declensions and conjugations. The memorizing of these exceptions, however, is not a serious matter as compared with the time spent in classical schools in learning the quantities of vowels in Latin words. In the English universities, Oxford and Cambridge, and at the English preparatory schools they learn not only the laws for quantity, but they learn the numerous exceptions and the innumerable cases of vowels which are long or short only "by usage." They learn these with such painstaking as would be required to make Latin poets, and they test the quality of their scholarship by actually requiring written verses in Latin. This is all the more astonishing because no person knows precisely how the quantity of Latin vowels affected their pronunciation. There may be some shrewd guesses on this point, but there is little real knowledge on it and no complete theory.

One is led to suppose that the English gentleman desires to celebrate his contempt for what is useful not only in the line of bread and butter studies, but even in the line of producing science and literature. He studies the quantities of Latin vowels to show his contempt for utilities either in the conquest of nature or in the combination of men into social wholes for business or politics. I admit that in some cases, especially in the case of Tennyson and Milton, the study of Latin quantities may possibly have quickened the ear to the melodies possible in the English tongue, and that we owe in the case of Tennyson and Milton much to their work in the preparatory school in the way of learning quantities. But if "Shakespeare had little Latin and less Greek," he certainly excelled both Tennyson and Milton in his discovery of the capacity of his native tongue for a greater compass of music than the classic tongues ever possessed. However this may be, I for one am glad that American preparatory schools, especially in the public high schools, waste very little time in the learning of Latin quantities. For those who claim conservatism in this matter and insist with great stress on the study of quantity as the real key to the benefits of Latin and Greek there is very little defense, since the studies of comparative phonology and other branches of classical philology reached their height in the last generation.

It remains true and will remain true that in the English language Latin and Greek must be studied because they are still living languages and not dead languages, because they are the living languages not of the colloquial vocabulary of common sensuous experience, but of the scientific vocabulary not only of the strict sciences like mathematics and logic and physics, but of the experimental and historical sciences one and all, and because the characteristic vocabularies and styles of the great literary writers of English are to be identified through the possession which they show of fine shades of meaning and the newly attained powers of expression of moods of the soul, their refinements of taste, lofty aspirations, and subtle thoughts, all made possible by skill in using the

Latin and Greek derivatives, which reenforce the Anglo-Saxon vocabulary by a wealth of words three times as great as that derived from the old English.

W. O. Thompson, of Ohio, presented the following paper:

DISCIPLINE—STUDENT CONTROL.

The question of college discipline has been debated rather vigorously for thirty years. The changing conditions within the colleges, as well as the changing conditions in civic life, have made it certain that the college must meet these new conditions. Some changes in discipline and in methods of student control were manifestly imperative. Just what these changes should be was from time to time the vexed question. No one now doubts the wisdom of certain changes, nor is there any disposition, if there were the ability, to return to the former days.

First of all, there was in the earlier college a prescribed course of study, usually a dormitory system, an isolated location, where contact with very much of the world and its activities was difficult, and oftentimes a preparatory school, which admitted boys in the early teens whose parents asked for or expected a supervision of practically all the boy's habits. This last item was much emphasized in the minds of both the college and the patron. The college was expected to turn out high-minded men, of religious conviction and of moral worth. This confessedly high ideal was proclaimed not only as possible, but as one of the constant aims of the college. The result was that many people believed in the college, not so much for any intellectual results, nor for any culture it secured, nor for any efficiency it produced in the student, nor for any definite scholarship, as for the social, moral, spiritual, and religious development. People came to believe that the college was a good place to send almost any boy because of these results. Accordingly the questions of discipline and student control were always important. The college must meet these in a satisfactory way or face the danger of losing its hold upon popular favor. Under this order of things there grew up certain customs, beliefs, and ideals that have continued to this day in the minds of many people. Students housed in dormitories and kept under the constant supervision of tutors, preceptors, and other officials, who were guardians of both morals and daily habits, came to believe that college pranks and student disorder were part of college life. They saw no inconsistency between the most fervid religious profession and the meanest of college pranks. There grew up the belief that students should not be expected to conform to the ordinary laws of conduct. The law of the land was intended for citizens, but not for students. They were still under some sort of a family government with which the State should not interfere. The old tradition of the town and the gown is a remnant of this college insanity. No student had any civic responsibility, and therefore no civic morality. Most of us have heard protests against discipline when college authorities held students to anything like the common standards among citizens. Nearly every college in the land, especially among the older ones, has suffered damage to or destruction of college property at the hands of students in obedience to traditions handed down from year to year. Moreover, these things were accepted as a matter of course by students, faculties, and the community. It has taken us long, weary years to grow out of these traditions and to secure practically unanimous consent to the truth that students should be held to a strict account for conduct and should be held by the same ideals as the ordinary citizen. The development of the public school did much to change our thinking and our standards. No board of education would trifle with pupils destroying or mutilating property as the college authorities have done. Accordingly we have developed a group of boys and girls in our public schools that are a little more sane on questions of civic morality than the old-fashioned student. When all our colleges abandon their preparatory schools the problems of discipline will be cleared up and the standard of student life elevated.

The State universities have also made a distinct contribution to the results now enjoyed. As a rule these institutions regarded themselves as a part of the public facilities for education in an important sense, bound to pay respect to the public schools in the several Commonwealths. In the main they were without dormitories. The demand for the type of education provided at these institutions was so great that legislatures were kept busy in appropriating money for education rather than for a means of living. Being without dormitories in the main it became necessary for these universities to emphasize to their students that they were there at public expense and would be expected to conduct themselves as citizens should. Nearly all these universities abolished the preparatory school and therefore had an older grade of students than could be found in colleges having preparatory departments. Responsibility was therefore insisted upon from the start and students were brought to see that they were dealing with the State. Few of the traditions common in the earlier colleges ever fastened themselves upon the college life of students in State universities. The rapid growth of these institutions brought the public to see a large body of students free from traditions, representing practical democracy, and face to face with the problems of self-control.

The elective system sometimes attributed to Harvard, but really born at the University of Michigan, had much to do with changing the problems of college discipline. As soon as students were found at college confronted with the fact that the responsibility of their education was a personal problem they became serious. The elective system puts upon the college the responsibility of being genuine when it offers a course of study. It must have back of the announcement something that commends itself to the attention of students and that will command their respect if it is taken. The college can not evade and avoid responsibility by saying it is teaching an unfortunate text-book; the modern college offers *subjects*, not books, for study. It must be prepared to justify its announcement by a masterful treatment. In a similar way the elective system puts upon the student the responsibility of doing the right thing in his education. I am aware that many people sneered at children making choices and determining careers; nevertheless the modern college has insisted that students shall choose. What are the results? We find now that the questions of course of study and of career are debated at home and in public high school. A few students still come to college because they are sent, but most of them come because they want a larger opportunity. They are taking the college and university seriously. They are taking themselves seriously. The faculties have learned that such students require less discipline and more leadership. It has made the modern professor wake up to his opportunity and his responsibility. The college has also seen that it can not preach religion and talk upon the high ideals of spiritual culture and not be honest in its curriculum. This strong insistence upon a somewhat rigid morality has put a vigorous tone into all our colleges. Wherever troublesome questions remain we shall meet them best by emphasizing the duty of high-grade action in our colleges. Even football seems likely to surrender to the demands of the class room. Certainly nothing will more stimulate its ethics. Furthermore, it is worth while to call attention to the beneficent results that have come from the development of industrial education. The presence of manual training in the elementary and high schools has greatly improved the spirit there. In the colleges of agriculture and mechanic arts, and in all institutions where technical and industrial education of any sort has been introduced, there has been less of troublesome discipline than in the older colleges. When industry becomes a virtue idleness will become a vice. The student, consciously pursuing a course of study that leads somewhere, becomes enamored of his journey. The whole problem of discipline lies in the problem of securing on the part of the student a conscious pursuit of a desired end. All forms of industrial education put emphasis upon this. No student can successfully pursue a technical course such as the institutions in this association offer without some choice made in view of a definite purpose. At present the constant debate between the student and the college is as to the content of the course. The student thinks there is too much irrelevant matter in the course and the institutions attempt to justify these subjects by reasoning that the student does not appreciate. The subjects, he thinks, are too remote from his purpose. I am not now justifying either faculty or student; I only call attention to the fact with the added remark that the condition is pretty conclusive proof that the course is not in its final form and never can be. My desire is to call attention to the truth as I see it—that this attitude, this seriousness of purpose, has solved many of our most difficult problems in discipline and will solve more of them as we give it opportunity. In the older days the problem was to get the student to do what was ordered. In the modern days the problem is to get the college to do what ought to be done. Students are now less of a problem than faculties are. In proof of this witness the discussions in faculty meetings, a few echoes of which have been permitted to slip into public print under assumed names. Moreover, the discussions for the last two decades illustrated the same thing. Passing now these general principles on discipline and control, let us look briefly at the general plans that have been adopted as a working policy. These fall into three classes, namely, faculty control, student government, and administrative government.

I.—THE METHOD OF FACULTY CONTROL.

This was the earliest form and assumed that the teacher and the faculty were in *loco parentis*. The school assumed the family relation and family responsibility. The student, as the boy in the family, often became conscious of his growing powers and felt the right to assume responsibility. When this was practically denied by the form of the government a spirit of rebellion often developed. He regarded himself as an irresponsible creature. He never was quite clear that the paternal idea was well founded. He assumed that the faculty was against him and therefore he was against the faculty. The pleasing exception to this condition was found occasionally in some professor who was an inspiring leader and who was so beloved that in his classes discipline was invisible. The paternal idea brought many a boy to regard his teacher as a driver. The ideal is that he should be a leader. Further, under this system rules were the logical consequence. The faculty could not always be in bodily presence, but they could send a rule as representing them. Then, too, faculties adopted rules by a majority vote and it was not always clear that every rule or law had a sufficient sanction back of it. Indeed I think it fair to say that this system with its disregard for law was demoralizing. Mature men now laugh and alumni come back to the old college and hold up to laughter, if not to ridicule, many of the customs and laws under which they lived as students. The narrowing effects of much of this government can not be denied. We have come to see in these days that it is a mistake to overlook the dawning of maturity that is in the college student. He recognizes it and faculties ought to. The family expected the college to do much that is now done before the students start to college. In the modern life our boys have pretty well formed and stable habits before their college matriculation. This is not so much a matter of years as it is of experience. Many of the results sought after in the college are now secured in freshmen. Less freedom in college than the boy has had in high school will not be welcome to either parent or child. We are bound therefore to move away from the older methods. When this movement came it was impossible to return to the old order of things. Some other method was a necessity.

II.—STUDENT GOVERNMENT.

Naturally perhaps the college world turned to the method of student government. This was the other extreme and like all extremes attracted many people but was regarded with some doubt by the conservative. At the University of Illinois about 1869—then the Illinois Industrial University—an experiment on a large and elaborate scale was attempted. This really was a miniature republic with officers duly elected and charged with duties to which the students had assented under student legislation. That experiment was abandoned after a trial. A crisis came which tested authority which proved fatal to the whole plan. A full account of this interesting experiment may be found in the proceedings of the National Educational Association in an address by President Selim H. Peabody (see National Educational Association proceedings 1889, page 539.) Another notable experiment was with President Seeley at Amherst. Here a strong, forceful, and pleasing personality won the students to him and his methods. For a time student government flourished, but here as so often in political affairs the death of the ruler left a dismembered government. At Amherst there has been no successor to President Seeley in this particular. When we examine into the causes of the decline of student government we discover that it grants authority but can not fix and locate responsibility. At any moment a student may withdraw from college and leave nothing behind but a record of suspension or dismissal. This in no way compensates for the lease of authority. The college can not run away; it must remain as the residuary legatee of all the mistakes or blunders of the departed authority. Moreover the force of law lies in its penalties. A student court or legislature will neither decide nor legislate against students in a disinterested way. Faculties even will not criticise each other. They are very slow to discipline their fellow members. What then can we expect of students whose personal attachments are often closer and more biased.

In addition to these considerations, the State, through its courts, will not recognize the legal standing of a body of students. The responsibility for property, for the use of funds, and for the general welfare of the college is vested in trustees and faculties. Student authority is therefore, at best, delegated authority, with a strong reason to doubt whether the constituted authorities have any right to delegate to students. The whole situation lacks genuineness. The student is a temporary resident for a specific purpose, which is not government, but instruction. He is there voluntarily, with no definite or assured tenure of position. It seems irrational, therefore, that he should take into his hands the temporary administration of policies and interests of which he is neither the creator, the supporter, nor the guardian, but wholly the beneficiary.

This is not to say that a student or a body of students should not be consulted; it may be the highest wisdom to advise with such bodies. It is important that all available facts be known; that there be a clear understanding of all conditions and problems; but I object to the policy of fooling or trying to fool a student by leading him to think he is governing the college, where, as a matter of fact, the college is governing him if it is doing its duty and administering its trust.

III.—ADMINISTRATIVE GOVERNMENT.

The third method may be described as administrative government. This is the method steadily coming into use in all our colleges. Under this conception there are some things to be assumed—among them (1) that the college is a public opportunity, (2) that the property is a public trust, and (3) that the faculty is an organized agency for cooperation and leadership and the student a responsible party whose privileges are to be measured by his willingness and ability to make profitable use of the opportunities.

These conceptions banish at once from the minds of all the old notion of antagonism between student and professor, and put the college life on a natural and rational basis. The faculty is therefore naturally and properly the legislative body, and the president and other officers—such as deans in our larger schools—are the administrative officers. The whole government becomes one of principle. The modern college steadily approaches the spirit of democracy, where all students stand on a level of equal rights, with no favors. As soon as students come to understand this situation the sobering effect of responsibility is manifest. There can be no trifling with principle; hence the offenses against good government are serious. This view holds out that a student is not in college as an accommodation to the faculty or to the public; the faculty and the institution are there for his accommodation if he will use it properly. Colleges are steadily going out of the nursing business. Students must go elsewhere for their health or the indulgence of their whims. The college is for business, and a very serious and important business at that. The details of a student's life are important to the college chiefly because they help or hinder the great cause for which the college stands. I believe we have often weakened the cause of education by leaving the impression that discipline is an important issue. The truth is, it is only an incident. If the student can not understand this, he should be given to see that his preparation for college life is yet incomplete and that he ought to go elsewhere and complete his preparation. I believe thoroughly in a large and liberal spirit which locates responsibility, and in a system of government that has the courage and firmness to promptly say to students that their privileges as students cease when they fail to be good citizens.

The best test of a student's right to be in college is his satisfactory performance of the student's duty. The academic requirements should be insisted upon firmly and even rigidly. Insist upon it that education—the requirements of the curriculum—shall be promptly and regularly met. This attitude neither accepts nor makes apologies. The average student will soon see the force of this law and the justice of it. If he is not fit for such a school he will soon drift to his proper circle; but he will do it with increasing respect for the institution of which he was not worthy. That in itself is a valuable result to reach.

I believe, therefore, that the whole question of college citizenship should be defined by a few fundamental and important principles. These should be public. The student should be face to face with the law of the college, just as the citizen is face to face with the law of his land. These laws are made by properly constituted authorities and administered by properly constituted officers. In State institutions the force and power of the State is behind college administration. This fact should be clearly and persistently set forth. In a State institution or in such institutions as are represented in this association the supremacy of the law of the land and the necessity of good citizenship should be as clear as the day. College authorities should turn over to the State authorities every offender. It may appear rigid and cold in the first instance or two, but there will be a long interval between troubles. In my own experience I have not hesitated to declare that the law of the State would be enforced and that I should regard any destruction of property or interference with the rights of citizens or students as proof of a kind of citizenship that could not be endured in a college. I believe that American students respect an administration that respects itself and respects the law of the land. In a college, as elsewhere, the cure for disorder is a high order of citizenship. Let the high ideals of a genuine democracy inspire the colleges and we shall hear less of hazing, of dishonorable college traditions, but more of scholarship, of college fellowship, and of social service.

G. E. **Fellows**, of Maine. It appears to me that the student has three relationships in the university or college. One is toward the educational administration, whatever has to do with its class of work, his examinations, and his degrees; another relation is with his fellow-students and with the faculty as social members of the community, and the third is with the community at large—the public.

It should not be the part of the student in any way to dictate the terms in which he is related to the educational features of the institutions. Those are already provided for by statute or by the organization of the institution. As to relation to his fellows, there is no reason in my mind why there should be formal rules. I think most of us have come to believe that.

In the relation of the student to the citizen and public in general there is a growing desire to throw the whole responsibility on the civil authorities. I believe myself that that is the only way to deal with all such questions. I think the college authorities should not deal with them, but that they should be dealt with entirely by the civil authorities, and the sooner they are taken up by the civil authorities the better. I believe all sorts of offenses which in any way constitute civil offenses should not be ignored, but should be taken notice of as any other good citizen takes notice of them, but not in any way taken up by the college authorities for the purpose of college discipline. I leave purposely the relation of the students with each other and with the faculty in a social way to them, and after an experiment for two years it seems to be extremely successful in solving the difficulties that have arisen in that way. We do not give up our authority as regards offenses, if there be offenses against the educational orders and discipline of the institution. And we have disposed of the civil affairs as I have already told you. But with relation to the student affairs we have established a council called the university council, composed of three seniors and two juniors and four members of the faculty. The faculty members are elected by the faculty, and the two juniors who are elected serve through both their junior and senior years, and thus there are always two experienced student members of the council. At the beginning of the senior year the seniors elect a third member and the juniors elect their two new members. All affairs that seem to need attention, not necessarily of discipline, for the upbuilding of the institution or the furthering of student interest or the general furthering of university interests in the public, and with the State or the consideration of matters which really need attention in the way of discipline, but are not strictly related to the educational affairs of the institution, are dealt with by this council. In several instances the council itself—that is, the student portion of the council—has brought up to the whole council matters which needed correction in the student body. I do not think that the general body of students feels in any way that it is watched by the council, or that the council preaches too much. It does not often preach. The college meeting is called and the faculty are excused, and some member or members of the student council make little speeches on matters of general interest, the care of college property, the appearance of students in public or in neighboring towns, or in the matter of social entertainments, in such a way that we have been almost entirely relieved for the last four years of any kind of difficulties arising between the classes or between the fraternities or between students and faculty. I can not say that our system would satisfy any other institution. I do not know that it would. But as far as possible I have tried to keep the three relationships of the student separate, and I hope that time will establish customs which seem to be growing, so that we shall be free from the real difficulties of discipline.

J. C. Hardy, of Mississippi. The first thing that I think we ought to get before the student body is the correct view of the whole relationship—what the college is for. We make it very clear to our student body that the college is for them, provided they behave themselves and take advantage of it; that the faculty, president, equipment, and everything exists for the student, and that therefore any requirement that is made is not for the benefit of the president or for the benefit of the faculty or of the college authorities, but for the benefit of the student body, and that the college does not need him, but he needs the college; that the college was established by the legislature of the State for the purpose of giving opportunities to the young men of coming there and equipping themselves for life, and that the college has all the students it cares to have unless the student wants to come and take advantage and get the benefit of the work that the college is doing. I consider that the correct point of view of the purpose of the student's life and why he is there, and that it is essential to correct discipline. It brings out the idea that was mentioned of a student having a purpose in coming to college, and that very purpose sobering him and bringing him to decent living.

Another thing is the question of citizenship. There is no transformation that comes over a young man simply because he becomes a college student or any requirement that he should act differently from anybody else on the trains or elsewhere, and I think by presenting that point and keeping it constantly before the student, but in a common-sense way, the student will lose sight of the old stories that used to be told of how their fathers and grandfathers and uncles went off to college when few men went to college, and how they used to paint the town red and do a thousand different things. That is all being eliminated from college life, because students are becoming so common that they can afford to act like other people. We emphasize the point that the college is not only a preparation for life, but that the college is life; that every principle of life, every principle of decent living and decent citizenship that is in life is in that college. The man who is decent there is going to be decent outside, and the man who is not decent in college is not going to be decent outside.

The colleges of the country are concerned in having a high-toned moral sentiment in the student body, and that can be done only by making it understood that no young man can live in the college or can stay in the college unless headed in the right direction. I am trying to hold in mind, as president of our institution, the tendency of every boy, as to whether he is going in the right direction or the wrong direction. I classify every student that comes under my direction. As I step on the platform at chapel exercises, I can tell you whether a student is going in the right or wrong direction.

We do not have student control and we do not have faculty control when it comes to discipline. I do not believe in letting a question come to an issue. If you see a boy going wrong and you can not get him right, make him leave college. We cut off and trim down, so that it is hardly ever necessary that a case should be dealt with in a formal way, and in this manner we try to build up the correct public sentiment in the college. That is the main thing after all. It is the correct public sentiment in the college that dominates the college. I would not give a copper cent to keep any boy from doing this and that and the other simply by authority. But you want to get into him those fundamental principles and those high ideals of citizenship that will dominate the school, and the school just governs itself, because there are certain ideals you have got into the student body that the boy will not dare to offend against. When you get the student body to that point, then any correct discipline will carry with it the indorsement of the student body.

I think the next thing essential to discipline is sympathy and openness on the part of the college. The student body must always realize that those in authority are not seeking to find this and that and the other, but that the president of the college, if he is clothed with authority to administer discipline, is in sympathy with the student body, in sympathy with the very purpose and life of the student, and they must feel it at all times; and in order to do that the president must deal with them only. Speaking from personal experience, I never write home to a parent criticising or finding fault with a student, but have asked the student to come into the office and write home to his family. The boy must know that you are giving him a chance; and when you do that and use common sense, I think there will be no trouble in working out harmonious common sense in the way of discipline.

E. B. **Andrews**, of Nebraska. There are two or three specific problems that have not been touched upon by either of my predecessors in the discussion, and I will say a few words.

There is first the very specific problem of the college row. In the university where I am they are rare, but they bother me, and I am frank to state that they bother me more than almost anything else. I think they are a great pity, but I do not as yet see just how to right them. Of course if a student were hurt, I should urge him to prosecute, if I could get him to do so, the man who hurt him. Sometimes a student refuses to do this. I should also use the authority of the institution to find out who the guilty party was and discipline him still further. But the knowledge that that can be done does not always help to get proper relations or prevent improper relations for a short time between different grades and different gangs of men. In the institution where I am now the temper is better than any place in which I ever served where I could not have an audience room in which I could get my students together. The largest place of importance that we have would not house more than one-half of the students of the university. This makes exhortation of any kind exceedingly difficult and brings about an inability to impress noble principles upon the student body, and in the meantime our discipline troubles me at just that point. The best men in the university sometimes forget themselves and engage in class scraps. I do not believe the difficulties of one institution ought to be passed over to another, or to be blamed onto another, but every time these difficulties arise with us a few students recite the fact that other institutions are looking with tolerance upon the cane rushes and similar things. If that is so, I must express the opinion that I have expressed in these meetings many times, that I think it is a great misfortune. I do not see how you can help a regrettable occurrence of this sort if you do not frown on any sort of occurrence that is out of order. I lay down the proposition exactly along the line of what has been said before me this afternoon, that a thing that would be looked upon as disreputable and regrettable in the average town or city is to be looked upon as regrettable or contemptible in the great body of students, and if you do that on things intended to be innocent—like a cane rush, for instance—if your approval can be gained in such matters as that, I think you will be obliged to take up more serious ones. We have found that the little thing grows into the big and more regrettable thing, into matters of bloodshed and very serious personal injury, which, of course, after they have occurred, all persons speak of as regrettable occurrences. And yet we have never, where I have been, forbidden out and out that such a thing as a cane rush should be held. We have never passed a rule to the effect that any man who is engaged in any such thing should be expelled or should be dealt with, and this seems to be an advisable course. It works fairly well. Many a thing can be dealt with better by teaching against it, laughing it down, and calling it foolish, which it is, than it can be dealt with in any other way.

Another thing is the proper supervision of students in their own residences. We have no dormitories, and in the State universities and schools generally we do not have such. If we do have them, we have them in such numbers or with such capacity as to make it no longer necessary that students shall find their residences here and there. And I believe it was understood the other day when this matter was up in another meeting that there is a growth of the fraternity house. That is certainly so with us. How shall we deal with students in fraternal and sorority houses? They generally behave. I think in few fraternity houses there is drinking, which is to be deplored. I think all drinking is to be deplored, but what I mean is that sometimes there is a drinking bout. We try to get the resident members of the fraternities to intercede and bring influence in order to stop the practice, and sometimes they succeed and sometimes they do not. In all the places where I have ever had to do with the management of students I have often gotten the resident members of the fraternity or graduate members, even if I have to call them in from a residence elsewhere, to deal with their members and conferees in their fraternities who were undergraduates. Even this with us has not in all cases made it exactly right. In some of these houses some people do not study as they ought to, and take up more time in other things than they should. These things are not serious inconveniences, but they are troubles, after all, of a certain kind. But the worst problem, and I wish I could believe it was local purely, but I am afraid it is not, the worst problem is the disposition of a few students to crib, as we call it, in examinations. Perhaps that is the worst fault of American colleges to-day. It is with us a considerable evil. I do not think from what I have heard that it is worse with us than at other institutions of learning, but this trouble exists with us, and I do not for my part see just how to reach it. I can not think that in any considerable number of the institutions of this country it would be wise to leave the supervision of examinations to the students. I do not know whether it impressed other gentlemen as it did me when Dean Thornton of the University of Virginia was speaking the other day in one of the other meetings about the procedures that occurred in that eminent institution in the case of students cheating. The whole examination is practically, so I understood him to say, given over to the students. They are supposed to be on the watch, or at any rate no other watch is set than that which is spontaneously set by the students. And I think he said explicitly that unless a student who is charged with cribbing could make his fellow-students believe he was innocent he left the institution and never came back, and not only so, but the ill repute of this followed him through life, and that it was equivalent practically—though it was not his illustration, but my own thought—to being drummed out of the army, out of his regiment, or out of his corps, for desertion or cowardice on the field of battle. I do not know whether other people were affected the same way I was. I said that it was a hardship; that it is absolute injustice. If I lived in Virginia and had a son that was sent away in that manner and crucified for life and no trial was given him except that which would be instituted by his fellow-students I would do something. I would seek redress for my offspring if I could. If the laws of the State enabled me to get it, I certainly would get it. I can not think of anything more unjust. It may work very felicitously. It may save responsibility and trouble for the administration. But I am one of those who believe that the administration of the university ought to deal with all of those things, and that there ought to be strength enough and method enough in the administration of any university to oversee the examinations that are officially set, and that every resource of the university ought to be brought to bear to see that the examination is fair, and that it is actually taken. The marks that are gained on a large part of the examinations are of monetary value when a man graduates, and how terrible a thing it is that a man shall get by cheating a chance to earn a salary which but for his cheating a fellow-graduate might have been able to earn in his place, and he earns the money without deserving to earn it. Such cases as that are rather rare, but such cases might arise if we do not properly supervise our examinations. We have made some effort in the University of Nebraska to check this evil, and with considerable success. A number of students since I went there have been sent away for participation in this great crime. I always try to explain that it involves the crime of lying. If it is the usual written examination, he has to write only that which he has found out by his books in a proper manner and not take from anybody else there and write down matter which he has gathered out of a book and made notes of on his cuff and that does not properly represent his own mind. And, further, he is obtaining a credit to which he has no strict moral right. There is, therefore, all of the moral turpitude of lying and bad faith.

All of our men who graduate in technical departments can have occupation the very next day after they get their diploma if they are willing to take it. Civil engineers have that chance, mechanical engineers have that chance, electrical engineers have that chance, and graduates in agriculture have that chance, and I for my part feel that no man ought to steal his way to that degree, but that if he gets a certain salary he ought to earn it. Of course it is easy to say that probably even if a man does crib now and then he earns his degree. I think he ought to earn it entirely. I should feel wicked if I had any part in letting a man secure a degree in any institution of learning where I was placed unless I felt that he earned every particle of the credit brought by that degree.

These are the three specific problems, Mr. Chairman, that have come to me as I have listened to these interesting and valuable remarks, based upon such experience as I have had.

W. O. THOMPSON. I should like to say a word or two in view of my paper and the subsequent remarks, and I desire to address myself specifically to two or three things which Chancellor Andrews has brought out. For instance, the class contests. I do not want any inference that we do not have such things in Ohio. We have them every year. I think it can be said honestly that we had the best class rush in America this year. We open our schools for registration of the students on Tuesday. We have the machinery so we can register 1,500 students, who are installed regularly. On Wednesday we deal with the irregulars. Then comes the day with a clean card, and the Y. M. C. A. always give a reception on Friday night. On Friday at 4.30 the rush is on. I can not go into all the details, but I have put the proposition to the student body in this way: That a contest between classes is just as fair as a contest between football elevens, provided it is a fair, square, and manly contest, and under no other terms would I be satisfied. Now, I do not want any college rushes, but if we are going to have this sort of thing we will do it just as reputably as a football team in its contest with another team. They have agreed to that. Now they come in to me the very first day and say, "Mr. President, the distance is measured off and everything gotten ready," and I go out in the field at the appointed time and take charge of it, and when the whistle blows the rush stops. The truth is I have taken seventeen-twentieths of the glory out of it, and nobody goes into it unless he wants to do so, and the result is that they can not get anything like 6 per cent of the students to engage in it. I can not go into the details of that now, but it is recognized that "Prexy" has the situation in his hands. For instance, they have got a cane and they have got a certain distance, and I go out in the middle of the field. They are already in their place. When I give the signal, they start. We had over 5,000 people come up to see the rush last fall, and they came in automobiles and carriages and everything else.

Now, the truth is that these fellows respect me in that situation. I have the assignment of rooms. Whenever an executive order goes out it has got to be obeyed, and if a fellow does not obey he will go from the college quickly. One rule is that no meeting can be held in any university room without the consent of the president. So if I assign the sophomores a room they can have it, and anybody disturbing that meeting will have to get out of the university. If any university organization wants a room, I will say to them, "I will be glad to accommodate you provided somebody has not been here before and got the same accommodation, but you must never interfere with anybody else." The result is that we do not have any kidnapping business. I have never had any disorder with that sort of thing. Now, I use that simply to illustrate that I believe in the administrative principle. They would not think of having anybody else as referee and would not think of doing anything until they got Prexy's consent. So much for that.

I will give you an illustration of another matter. I have never revised a decision since I have been a college president, and what is more, I never will. I am very slow to make them, but when they are made they are made. A few years ago our glee club went to Marysville; a reception was given them, and about 1 o'clock in the morning they got home drunk. That was about five years ago, or six. I had happened to come to Washington at the time. As soon as I returned to Columbus I went up to Marysville and saw the register of the names of the students that had stopped there. I sent for these young men to come in and see me. I told them that I had not read a paper. I said: "I want you to tell me of your own free will just what happened as far as you are willing, but I do not want you to incriminate yourselves." Everyone admitted the truth. I sent a second notice, saying: "Now, I want you to come in a second time, to show why you should not be suspended from this university." Every man came in. They went over the thing, and every last one of those fellows went out of college. They went out until the next June. Several of those boys came back and graduated, and are the warmest personal friends I have in the State of Ohio to-day. I never have suspended a student from the university who did not first say that he ought to be suspended. I stand toward a student disorder just exactly as I would stand toward a disorder if I was President of the United States. I say: "The law has got to be maintained, and you get right out of here. If you want to have a class rush, you can not have one if it is disorderly, and whenever you are disorderly and that fact comes to my knowledge you will get out of this institution right there and then." And I issue the order. I believe in the supremacy of the law there. The State universities and agricultural colleges stand under the law of the United States as democratic institutions in which the supremacy of the law is to be regarded. I have never suspended a student when I was angry in my life. I have never disciplined a student until he was brought face to face with me and stood in the presence of his fellows, and the result of that is that they know if anything goes wrong with a student I wish to see justice done. I would miss any important engagement in this country if the question of a student's welfare were at stake. I want the students to feel that if they get up to the president they will have a square deal. After all, we have got to administer these great trusts as men, and I would not, if my honor, my integrity, my truthfulness, were impugned, in an institution, be president twenty-four hours. I believe this whole question of college administration and discipline is solved when you lead a fellow to come right to you and do the right thing, although you have to suspend him from college.

The other day a man called me up about the employment of a certain young man. I informed him that he was all right; that I had suspended him from the college, but that I would guarantee him now. He said: "That is a curious remark, but I will take him." The boy knows that I stand by him. I tell you there is a mighty saving power in the spirit of justice, dealing fairly and squarely in these propositions. What I despise of all the things in some of these places is the disposition to cover things up and get away from them

In that matter of examinations I have suspended a number of men from the university, and I have never failed to suspend a man for the remainder of the year. I face him with it and ask him to present the situation, and if he is guilty of that sort of thing out of college he goes. There is no other penalty. He understands that when the time has expired he has served his penalty and that he is free again to come back just as he came in originally, and without any discrimination whatever.

E. B. Andrews. May I say just one word as to the official rush? I wish I could see some merit in it. On the other hand, I can not see it at all. Such a thing with the students I have to deal with I know would work evil. I can not see how it can fail to work evil at the Ohio University or any other place. And I have never in all my life heard, outside of college communities—and we are talking of the civic administration of college people—I have never heard of anything of that sort taking place, at least not as a regular thing. It is always a spontaneous outburst; it is unpremeditated, and so is not the thing President Thompson is talking about. I think in all the companies of students that I have been associated with the official rush would lead right straight back to barbarism.

K. C. Babcock, of Arizona. I have had experience with two institutions, and at one it terminated in a row. The other was at the University of California, where they had a barbarous night rush. They had an official rush one year. After that the faculty smashed the whole business.

The Chairman. President Thompson, how do you take care of things when you are not there? Do you have a faculty system or a system of proctors?

W. O. Thompson. As far as taking care of things is concerned, I think I am always there. At least my inspirational presence. I am rarely absent. This is the longest absence this entire year for me at any one time. I stick pretty close to the machine. But in temporary absence I appoint the dean, who will have charge, and whatever he says will go. All of the other details are in the hands of the executive clerk.

Thereupon the section adjourned for the day.

AFTERNOON SESSION, THURSDAY, NOVEMBER 16, 1905.

K. C. Babcock, of Arizona, presented the following paper:

THE LAND-GRANT COLLEGES AND NORMAL SCHOOLS.

For the purposes of this discussion, normal schools must be differentiated into two classes—the city normal school, preparing teachers for urban conditions, and those normal schools, by far the greater number, which prepare the teachers for the schools of the small town, village, and rural community. The land-grant colleges can not, in the nature of the case, expect to influence very powerfully, on the agricultural side, such normal schools as those in New York City, Cook County, Ill., or San Francisco, Cal. But in the case of schools like Cortland and Oneonta, N. Y.; Platteville, Wis.; St. Cloud, Minn.; Greeley, Colo., and Chico and San Jose, Cal., very much that will be vitally and permanently profitable can and must be done. Just what should be undertaken, and just how to proceed in this period of transition to a deeper and more scientific interest in country industrial life, are questions which must be settled slowly by a combination of common sense, a little pedagogy—not too much—and a great deal of thoughtful, painstaking, patient experimentation. Some suggestions are certainly opportune at this time.

Under pressure of circumstances, under stress of scant means, under the incubus of cocksureness on the part of those method-ists who have solved all the educational problems of life, death, resurrection, and the world to come, the children of the rural school, of the suburban residential community, and of the crowded sections of great industrial cities, are all treated to substantially the same medicine. All ignorance and all lack of interest look pretty much alike to the teacher narrowly trained in the still pervasive pedagogic notions as to right methods and times in arithmetic, reading, geography, and history. A certain New England preacher of a by-gone day was asked how he had managed to bring up a family of ten children on the unprincely salary of $400. His reply was that he found out the food the children did not like, and gave them lots of it. In the rural schools this principle has been applied all too consistently, and the chief marvel is that more men and women have not been spoiled in the making. Thirty years ago, and perhaps last year, graduates of the best normal schools of New York taught in the small villages of that State, with a serene and blessed indifference to nearly everything which distinguished country life from city life. Of course the principles of mathematics and of good English are the same everywhere, and there is no short toll road to the knowledge of them. But no one familiar with the conditions of country schools and of grade schools in the cities for that matter will attempt seriously to controvert the statement that there is lamentable waste of time and energy in all the primary and intermediate work. Great accumulations of material are unutilized for educational purposes in the country schools.

It is clear that there is a strong tendency in recent years to raise higher and ever higher the standards of requirements for teachers' certificates. The high schools want teachers who are college graduates. Grade school officers, backed in some States by statutes, require graduation from a college or normal school as an element in the qualifications of their teachers. All this is good and praiseworthy, but it does not seem likely to remedy all the ills which might be ranked as major. Those who are interested in raising the standards of living in the country, who want to increase the prosperity, deepen the contentment, and cement the attachment of country boys and girls to the life of the farm may well consider the normal schools as an open door into which they may enter with missionary zeal to preach to, convert, and inspire those who sit in darkness. If the children of this generation are to be kindled into real enthusiasm for the wonders and possibilities of their surroundings, if the drudgery of their daily routine is to be enlivened by a vision of the past and present processes of nature, it must be done by better teaching in the lower schools, by teachers who have knowledge and fire to be passed on to their pupils. To this end the land-grant colleges and the State universities must cooperate with the normal schools—compel some of them if need be—to prepare teachers far more effectively for instruction in the rural and village schools. Some of the normal schools have already gone far to meet the legitimate demands for teachers prepared for the organization of courses in manual training—for example, the Cook County Normal School. Here and there a strong school like the San Jose Normal School in California offers a course in elementary agriculture, but even this is not required of any particular class. However, with all these gains, scarcely more than a beginning has been made.

Mere knowledge of facts and methods will not suffice, since the aim of the reforms or changes under discussion is not so much addition to the already crowded curriculum of the public school, as it is an attitude of mind which will enable the teacher and pupils alike to understand and sympathize with the conditions under which such a vast number must live and move and have their being. Since the object is the interpretation of known facts, the infusion of interest into what has been but half known and wholly unappreciated, knowledge of how to manipulate the material at hand, how to correlate its sections, how to vivify it, becomes of cardinal importance, and right here the function of the normal school gains new significance. The normal schools must serve as educational transformers. The colleges and universities at this stage of the game are like great dynamos, furnishing scientific information and training and generating interest in the subjects to be taught. The normal schools must take this powerful, high-tension current and reduce it to such form that it may be safely and continually used by the millions with profit and cumulative satisfaction. The land-grant colleges may apply their knowledge directly, as at Cornell University and Iowa State College, through farmers' institutes, publications, and correspondence, and short sessions on an untechnical basis. In this way many adults of the present day may be reached, but the process viewed as a reformative measure is unsatisfactory—a palliative rather than a cure. To change the figure, it is but setting a few grafts well out on the limbs of a mature tree from which will come some improved fruit; while what is really needed is an early graft of the sapling, so that all its fruit shall be good, so that all the sap from the common earth and all the forces from the common air shall go to make fair and luscious fruit, not small, sour, scrubby, useless apples or grapes.

Cooperation of the land-grant colleges and the normal schools in this high endeavor has hardly begun. The initiative must certainly come from the college side, where the need is most appreciated and where the knowledge is ready for transformation and transmission. Assuming that these colleges are prepared, by their courses in the sciences and arts most applicable to country life, by their lectures within their own walls or in extension lectures, and through the workers in connection with the experiment stations, to furnish the teachers of teachers with equipment for their work, what may be asked of the normal schools? First, and most fundamentally, that they impress upon those whom they graduate the necessity of adapting the work in English, especially in composition, all through the grades, to the facts, experiences, and ideals of the real and enlarging life of the child in the community—less imitation of the stilted language of the readers and the literature prescribed and more of the natural expression of the thoughts that properly fill a boy's mind; less of "Snow-bound" and "Planting the Apple Tree" for pupils in southern California, and more of the planting and care of an orange orchard, or the ways of getting and using water for irrigation. Second, that the work in nature study be enlarged and steadied, relieved of the air of sentiment which too often envelops it, and turned specifically in the direction of agriculture in those schools which train largely for nonurban schools—the ways of brooks, the sorting and germination of seed, the ways of animals, the meaning of temperatures. The normal schools may reasonably claim the active cooperation and assistance of the land-grant colleges in this training of teachers. Courses of lectures could easily be arranged in subjects related to the topics just mentioned in such normal schools as Oshkosh, Wis.; Winona, Minn., and Charleston, Ill., by the staff of the land-grant colleges of those States; nor ought the men selected to give such extramural courses to be required to give them in addition to full regular work in their home institutions. Such courses should be counted as part of the regular duties of certain professorships. Short courses and summer courses may be made to serve the same purpose, though in such cases the prospective teacher may be required to go to the lecturer in place of the lecturer going to him.

In view of the new and hopeful demand for betterment of conditions of life in the country, it does not seem unreasonable to expect that the day is not distant when teachers applying for positions in the villages and in the country will be required to present evidence that they have taken courses along the lines suggested in this paper, by which they will be prepared for intelligent stimulation of enthusiasm for the wholesome life of the country in the minds of those who shall soon shape the course and sentiment of the vast agricultural population.

W. J. Kerr, of Utah, presented the following paper:

THE RELATIONS OF THE LAND-GRANT COLLEGES TO THE STATE UNIVERSITIES.

From the time of the establishment of the land-grant colleges, the question has been agitated, in one form or another, as to the extent and character of the field these institutions should occupy; the relations that should exist between them and other colleges and universities. During recent years the people have become better acquainted with the work the agricultural and mechanical colleges are accomplishing in promoting industrial education and the development of the industries and resources of the country; and, consequently, there is a better understanding regarding the functions and scope of these institutions.

Even yet, however, there is a divergency of opinion on these questions. In some of the States there is still an agitation of the question as to whether the land-grant colleges should be primarily or exclusively trade schools, their object being to train farmers' sons for the practical work on the farm, and tradesmen in blacksmithing, carpentering, and other handicrafts; or whether they should be strictly educational institutions of college grade. If the latter, should they be schools of agriculture only, or should their scope be broadened to include other courses? What place should these institutions occupy in the public school system of the country? What relationship should they bear to the State universities?

That these important questions are not yet definitely settled, and that there is no general agreement upon them, even among educators, are conclusions justified by the recent controversies in a large number of States about the distinctive spheres of the universities and land-grant colleges, and the widespread agitation, throughout the Middle and Western States at least, of the question as to the policy that should be pursued in the development of the State institutions of higher education. For example:

In South Dakota, last year, the governor, in his message to the State legislature, reprimanded the State university for unduly emphasizing, as he thought, the work in engineering; and censured the agricultural college for offering courses in Latin.

In North Dakota, two years ago, the governor recommended to the legislature that unnecessary duplication of courses in the State university and the agricultural college be avoided, and that "each institution should be kept within its special sphere."

In Iowa, the legislature appointed committees to visit the different State institutions for the purpose of investigating their needs and reporting on the appropriations required. The committee appointed to visit the university recommended in its report that the engineering courses offered in that institution be discontinued, and that all engineering work be concentrated in the College of Agriculture and Mechanic Arts. However, the legislature made the usual appropriation to the university for the maintenance of the engineering courses, and a special appropriation for an engineering building; but appointed a commission to consider the advisability of putting all State educational institutions under a general board of control.

In Colorado a bill was introduced in the legislature providing for the appointment of a commission to adjust the work of the State University, the Agricultural College, the State School of Mines, and the State Normal School. The introduction of this bill was the result of the agitation that had continued for a number of years regarding the respective fields that these institutions should occupy in the higher educational work of that State.

In Utah, after a protracted struggle between the university and the agricultural college, extending throughout the entire session of he last legislature, over the question of uniting these institutions or of transferring all engineering courses from the college to the university, a bill was finally passed providing for the appointment of a commission to investigate the question of college and university work, and to report, with recommendations, to the next legislature.

For a number of years the people of Montana were agitating the question of the advisability of consolidating the university, the mining school, and the agricultural college. In 1902, under the authority of the legislative assembly, the State board of education carefully investigated the work of these institutions and the conditions relating thereto, and by unanimous vote "declared that it was not feasible to attempt consolidation." The governor in his message to the legislature in 1903 expressed the belief that a further agitation of the question would accomplish no good and would "be altogether harmful to the State and detrimental to the cause of higher education."

On the other hand, in Idaho, where the land-grant college and the State university are united, a strong effort was made to secure the passage of a bill separating these institutions. While no definite action was taken at the last session of the legislature, there is still a strong feeling among a large number of the people of Idaho in favor of separation.

In Wyoming, also, there is talk of dividing the State university, and maintaining the land-grant college as a separate institution.

In California $150,000 was appropriated by the last legislature for the purchase of a farm to be used in connection with the work of the agricultural college. Suitable land, it is said, can not be secured in sufficiently large quantities in the immediate vicinity of the university, and advantage is taken of this to agitate the question as to whether the land-grant college should not be separated from the university.

In some States, where the land-grant colleges are associated with the State universities, difficulties have arisen over questions relating to the rank of the colleges or departments of agriculture and mechanic arts with the other colleges or departments of the university. This was particularly true during the earlier history of these institutions.

The conditions affecting the work of the State universities and the land-grant colleges are so diverse and depend so largely upon local environment that it seems impossible to work out a general plan that shall be applicable throughout the country. But it should not be impracticable to reach an agreement upon a number of the most important matters bearing upon this question. In order to determine the relations that should exist between these institutions it is necessary to consider, first, the origin of State universities and the objects in view in their establishment; second, the function and scope of State universities prior to 1862; third, the origin of land-grant colleges and the purposes of their establishment; fourth, the concurrent development of State universities and land-grant colleges since 1862; and, fifth, the present scope and character of these institutions.

The limits of this paper preclude anything like a complete discussion of these questions. As a basis for the conclusions which are to follow, however, it is important that brief reference be made to at least a few of the leading features.

The origin of the State university dates back to the famous ordinance of 1787 for the government of the Northwest Territory. This ordinance declared it to be the duty of the nation to support education, and reserved two townships of public lands in each State for the maintenance of seminaries of learning. The States which were subsequently organized out of the Northwest Territory carried out the educational provision of this ordinance, and through thirty-two separate acts of Congress, passed largely during the first half of the last century, all of the States west of the Mississippi received similar land grants for the endowment of universities. Under these acts approximately 1,500,000 acres of land were granted for the endowment of institutions of higher education in twenty-two different States and Territories. The purpose in view was the establishment of a university in each State, under the control of the Commonwealth, to promote, in the language of the ordinance "good government and the happiness of mankind." The character of the work contemplated for these institutions is indicated in the provision of the ordinance which declares that the land granted should be used for the support of a "*literary institution*, to be applied to the intended object by the legislature of the State."

The oldest of these State universities established under the ordinance is the University of Michigan, founded in 1837. The University of Missouri was established in 1840, and the University of Wisconsin in 1848. Most of the other State universities have been established since 1868.

At the time of the passage of the Morrill land-grant act in 1862 the accepted type of higher education was the four years' course of the old classical college. The conventional courses in classics, literature, and philosophy were the leading features of college work. The State universities were expected to be, as it was declared in the organic act that they should be, *literary institutions*. They were confined for the most part to the traditional courses of the time, and differed little, if at all, from the old classical institutions.

During the years immediately preceding the passage of this act, extending over a period of about two decades, great progress was made in the development of the country, and there was an increasing consequent demand for trained men for responsible positions in the different industries. As stated by President Dabney, " great railroads were to be built, but with the exception of the Military Academy at West Point, there was no school to train the engineers to survey them. Mines of coal and iron were to be opened, but miners had to be imported to open them. Factories needed to be built, but engineers had to be brought over from England or Holland to build them. Ironworks and many other important industries were calling loudly for chemists, who had to be obtained from Germany or France." Moreover, the impairment of the natural productiveness of the soil, the depreciation of farm crops, and the resultant general deterioration of farm properties were earnestly calling for the remedial applications of scientific methods in agriculture. It became evident, therefore, that the old college was not meeting the new demands. A new type of education was required, an education bearing more directly upon the arts of life.

It was to meet these particular needs of the people in the development of a new and rapidly growing country that the Morrill Act of 1862 was passed. Under this act nearly 11,000,000 acres of lands were granted to the different States for the endowment of colleges, the leading objects of which should be " to promote the *liberal* and *practical* education of the industrial classes in the several pursuits and professions of life." As explained by Senator Morrill, " the fundamental idea was to offer an opportunity in every State for a liberal and larger education to larger numbers, not merely to those destined to sedentary professions, but to those much needing higher instruction for the world's business, for the industrial pursuits and professions of life." It is clearly evident from the provisions of the Morrill Act, and from all the speeches delivered in Congress relating thereto, that the object was to provide for a new type of institutions, occupying a distinctive field as scientific, technical colleges, adapted to the needs of the great laboring classes in the development of the industries and resources of the country. But it is also to be observed that a *liberal* as well as a *technical* education was contemplated—an education for skill and efficiency, but for culture as well. The purpose, therefore, in the establishment of the land-grant colleges was to provide an education, to quote again from Senator Morrill, which " should prove useful in building up a great nation—great in its resources of wealth and power, but greatest of all in the aggregate of its intelligence and virtue."

The development of State universities and agricultural and mechanical colleges since 1862 involves largely the history of the growth of higher education in the United States under Federal and State control. While great interest had previously been taken in higher education, there was special emphasis at this time upon the necessity of the colleges and universities affording opportunities for the special training required in the development of the civic institutions, and particularly of the economic interests, of the country. The passage of the Morrill Act gave new impetus to educational endeavor and resulted in a general effort to secure the establishment of a college or university under the direct control of the Commonwealth in each State and Territory. During the first decade no fewer than twenty-four State institutions of higher education were established. As the country developed and new States and Territories were organized colleges and universities were founded, until at present every State and Territory except Alaska maintains at least one such institution. Some of the States combined the land grants of the Morrill Act with those of the ordinance of 1787 and the supplementary acts of Congress for the establishment of State universities, but most of the States kept the Morrill grants separate and established special colleges of agriculture and mechanic arts.

Thirty-eight State universities are now maintained in as many different States and Territories. Of these 20 are land-grant institutions, of which 16 were established after 1862 and owe their foundation to the Morrill Act, while in four of the States the land grant went to existing institutions.

There are 65 land-grant colleges and universities established in all the States and Territories except Alaska. Of these, 20 are united with State universities, and 15, under the Morrill Act of 1890, are maintained in the Southern States for colored students.

In 1903 the aggregate income of the State universities was approximately $9,750,000, and the value of their equipment and permanent funds was nearly $55,000,000. More than 45,000 students were in attendance, and the number of persons in the faculties exceeded 3,600. In connection with the above it is interesting to note that the 18 universities which do not have the benefits of the acts of Congress of 1862 and 1890 had a total income of less than $3,000,000, with equipment and permanent funds estimated at less than $15,750,000; while the attendance was 16,400 and the number of instructors about 1,200.

The statistics of the land-grant institutions for the same year are as follows: Income, $10,700,000; value of equipment and permanent funds, $70,000,000; number of students, 52,500; number of instructors, 3,600. During the year 1904 there was an increase in the revenue of $2,300,000, in the value of property of more than $3,516,000, in the attendance of nearly 4,000, and in the number of instructors of more than 700.

As has been stated, the first universities which were established under the ordinance were much the same as the old colleges of the time and were confined mostly to the classics, literature, and philosophy. But the factors which combined in securing the passage of the Morrill Act of 1862 were also potent throughout the country in modifying public opinion on questions of educational policy, relating not only to the work of the proposed institutions of higher learning, but also to the directions in which the existing institutions should be developed. The people of Wisconsin, for example, in 1858 demanded that in the university of that State "a more distinct bias should be given to its instructions in the direction of the several arts and avocations as they exist among men." With the development of the State universities, therefore, there has been a general broadening of their sphere and a gradual introduction of professional and technical courses, until at present these institutions may be said practically to cover the entire field of higher education, the scope and character of the work offered being limited only by the extent of their income.

The function and scope of the land-grant colleges are clearly defined in the Federal law, which declares that "the leading object" of these institutions shall be, "without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts * * * in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." The supplementary act of Congress of 1890 further emphasizes the character of the work that shall be provided for in these institutions, wherein it specifies that the money appropriated shall "be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life."

It will be observed that particular stress is placed upon the "leading object"—to apply science "in the industries of life;" to promote the education, "liberal and practical," primarily of the "industrial classes," not only in the "several pursuits," but in the "professions in life." There is special emphasis upon "agriculture and the mechanic arts," and also upon the "branches of learning" related thereto, "without excluding other scientific and classical studies." As interpreted by the Department of the Interior, and agreed generally by educational authorities, the "mechanic arts" of the Congressional acts are not confined to mere manual training in the handicrafts, but comprehended the most extended courses in engineering—civil, mechanical, electrical, irrigation, etc.

It is evident, therefore, that the work of the land-grant colleges should cover a broad field, including not only the technical courses required in the development of the varied industries and resources of the country, with thorough training in all of the fundamental cognate sciences; but also the general training in language, literature, history, and civics, which constitutes an essential part of a liberal education. While the distinctive features are made clear and emphasized, there is no inhibition as to the extent of the courses to be offered; and hence there are really no limitations to the scope of these institutions except those conditioned by environment and income.

What, then, should be the relations existing between the land-grant colleges and the State universities?

(1) In the States where these institutions are united the agricultural and mechanical departments or colleges should be coordinate with the classical, literary, and other departments or colleges of the university. Since the universities in these States are essentially land-grant institutions, receiving the benefits of the income derived from the funds of the land-grant act, and the appropriations of the acts of Congress supplementary thereto, it is consistent to assume that the distinctive features of the land-grant colleges should be emphasized and given at least equal recognition with the other courses.

(2) In the States where the agricultural and mechanical colleges and the State universities are maintained separately, particularly in the newer States with comparatively small population and limited revenues, it is important that

the respective functions of these institutions should be clearly defined in such way as to avoid, as far as practicable, the duplication of expensive courses, and to prevent either institution from encroaching unnecessarily upon the distinctive field of the other.

(a) In the land-grant colleges special emphasis should be placed upon the applications of science. Scientific investigations should be encouraged, but with the view of their practical value rather than for the purpose merely of extending the borders of knowledge. These colleges are primarily schools of technology, in which agriculture, the mechanic arts, domestic economy, and commerce may be regarded as distinctive features, the extent to which each institution should develop courses along these different lines varying with the conditions in the several States.

(b) The State universities in such States should give prominence to the work in literature, classics, philosophy, and such professions as law and medicine. It should be recognized that one of the chief functions of the university is to encourage literary and scientific investigations, to discover truth for its own sake, to increase knowledge independent of the question of its possible applications.

(c) The logical division of work between these institutions would be to have all of the technical courses in the college and the literary, classical, and professional work in the university. But this plan would not be feasible in all of the States. Local environment and policies previously established must largely govern in the final adjustment of this question. For instance, in some of the States certain engineering courses might be given more advantageously in the university; but in any case, in the States under discussion, the same expensive technical courses should not be given in both the college and the university.

(d) Whatever division may be made of the engineering courses, the work of the college should be that which relates most directly to the development of the resources and industries of each State, such, for example, as the irrigation enterprises so important in the reclamation of the arid and semiarid regions, or certain manufacturing interests in other sections of the country.

(3) In the older and more populous States, such as Michigan, Iowa, Indiana, and possibly Kansas, the work of the State university and the college of agriculture and mechanic arts might consistently cover a broader field, each institution offering certain courses given by the other, particularly in engineering. But even here a wide variation in the methods of development and in the extent and directions of application will no doubt be found in the same courses offered by these different institutions.

(4) In any event, however, whatever the final division of work between these two institutions, and to whatever extent certain courses might be paralleled, even in the wealthiest States, each institution should still occupy a distinctive field, to the extent at least (1) that the State university should not offer courses along any of the different lines of agriculture; and (2) that the agricultural and mechanical college should leave the field in the liberal arts and in the professions of law and medicine exclusively to the university.

(5) In the foregoing discussion the word "courses" is used to cover the requirements for a degree. However desirable, and to whatever extent it may be practicable, to avoid a duplication of courses in the land-grant colleges and the State universities, it is impossible that a large part of the general work of these institutions should not be the same. As already indicated, and as clearly shown in the previous papers read at this convention, the distinctive courses of the land-grant colleges rest fundamentally upon thorough and extended training in the mathematical, physical, and natural sciences. These sciences must also be taught in the State universities. Moreover, both institutions should afford the general training in language, literature, history, civics, etc., required in a liberal education. The modern demands in education forbid that any State institution of higher learning should be confined to a narrowly prescribed course of instruction. Along with the distinctive work in any of the technical courses the demand for a liberal training is imperative and can not be ignored. In the language of Doctor Jordan, "education in literature, philosophy, and the sciences is now more than a luxury, more than the possession of the recluse, more than the necessary equipment of the old-time professions; it has become essential to modern industrial life and a potent factor in industrial progress."

(6) After all, the question which is being agitated in different States regarding the relations which should exist between the land-grant colleges and the State universities is largely a question of income, and can not be settled merely

by prescribing the work, by legislative enactment, or otherwise, which each institution should offer. So long as these colleges and universities are dependent for support upon periodical appropriations from the legislature there will always be controversies sure to arise regarding the amounts each institution is entitled to receive from the State. These widespread agitations are not only expensive, but prejudicial to the interests of higher education. It is important, therefore, that some means be devised by which permanently to adjust the difficulties and establish more harmonious relations between these institutions. In connection with the foregoing the following plan is suggested:

(a) That a thorough investigation be made under legislative authority to determine the proportion or amount of the annual State revenue that can be devoted to higher education.

(b) That a similar investigation be made of the work and requirements of the institutions of higher learning to determine the proportion of the amount provided by the State for higher education that should be given to each institution.

(c) That a statutory levy be made on all the assessed valuation of State property sufficient to provide each institution with the required annual income.

If this plan were adopted as a permanent policy (1) it would provide a regular fund, which would increase with the growth of the State; (2) it would insure a more stable higher educational policy; (3) it would enable the boards of control to know approximately what their income would be for years in advance, and thereby to plan their expenditures more wisely and more systematically; and finally, (4) it would relieve the State of the embarrassing and expensive contentions, at each recurring session of the legislature, over the question of appropriations for the land-grant college and the State university, and the attendant controversies regarding the respective functions and the comparative value of these institutions.

A. C. True, of the Office of Experiment Stations, presented the following paper:

THE LAND-GRANT COLLEGES AND THE PUBLIC SCHOOLS.

The door of opportunity for the land-grant colleges in their relations to the public schools swings both ways. The colleges need to aid in strengthening and improving the schools, because from them must come the great majority of the college students, and it is therefore highly important that the public schools shall give the right kind of preparation for the courses offered in the land-grant colleges. The door between the colleges and schools must have the right inward swing. But the colleges should also ally themselves closely to the public schools in order that the schools maintained by the people may feel the inspiration of the great educational motives on which the system of land-grant colleges is based. And therefore the door between the colleges and the schools should swing easily outward and the college men and school men should frequently pass to and fro through it.

The fundamental thing is that the public school system should be efficiently organized to meet the educational needs of the masses of American youth, and therefore, like the land-grant colleges, it should provide an education which, whatever else it does, should directly aid the "industrial classes," constituting the vast majority of our population, to succeed in the several pursuits and professions of life. Ninety-four per cent of American children do not get beyond the common school; 4 per cent attend the high schools, and less than 2 per cent receive any instruction in colleges of any kind. It is obvious that the main purpose of the public schools should be to prepare for life, rather than for college.

Our school system has been the outgrowth of a plan of education framed to meet the requirements of the favored few who, under an aristocratic social scheme, were destined for leadership in letters, statesmanship, medicine, law, and theology. Such modifications as it has thus far received as the masses have come into the public schools have mainly tended to direct the youth to those pursuits in which manual work is reduced to a minimum. The great industries of agriculture and mechanic arts in which most of our people are engaged have thus been discriminated against in our system of public education, and the minds of our people have been prejudiced against them in the schools maintained at public expense.

Obviously this is wrong, but grave as this offense is it is not the only injury wrought by such a school system. For of late the wisest educators have come to see that the training of the hand and of the practical sense which may be given through instruction directly related to industries is an essential and valuable feature of a complete education and should be given to all children, whether they are destined to make manual arts their life work or not. In other words, the ideals of education should be changed so as to take in man and his environment as a whole, rather than part of man and part of his environment.

Since it is for this broader view of education that the land-grant colleges especially stand, they should actively exert themselves to extend the range of this new ideal of education until it permeates our entire educational system. In doing this they should not permit the adherents of the old educational ideals to claim that the land-grant colleges favor an industrial as distinguished from a cultural education. To set these two ideas over against each other is most unfortunate. It is an education truly and completely cultural that we should demand, and our insistence should be that no education can be completely cultural which does not contain the manual or industrial element.

Under the terms agriculture and mechanic arts in their broadest application may fairly be included all the dealings of man with the natural world (i. e., with the mineral kingdom and with plants and animals) for his own advantage, and in a true sense agriculture and mechanic arts are just as much a part of the common life of mankind as music, language, or mathematics. For this reason studies in agriculture and mechanic arts should be a constant element of the entire educational system. In the lower schools we should not seek to introduce teaching of particular industries and trades in agriculture and mechanic arts, but rather instruction in those facts and principles which lie at the basis of all agriculture or mechanic arts and those operations which form a natural introduction to all agricultural industries and mechanical pursuits.

There is, I judge, no necessity in this association to argue in favor of such an ideal of education, for we are already committed to it. The question we need to discuss is how can we best exert our influence to secure the practical application of this ideal in our public schools.

To make their activity for the promotion of newer ideals of education effective in connection with the remodeling of our public school system the land-grant colleges should do specifically the following things:

(1) They should study the programmes, text-books, and equipment of the public schools and formulate desirable changes in them.

(2) They should in various ways come into close touch with the school officers and teachers and by precept and example strive to show them a better way of educating the masses.

(3) They should provide at the colleges courses of study which will be attractive to school officers and teachers, and by summer schools or otherwise seek to bring such persons into direct contact with the system of education represented in these colleges.

(4) They should turn the attention of their students to the importance of the work of teaching and guide a considerable number of them into positions as school officers and teachers. This is very important. Hitherto the principals and teachers in our public schools who have received collegiate training have for the most part come from those colleges which represent the old type of education, and their influence has been predominant in our educational affairs.

(5) They should instruct the community through such agencies as the public press, the farmers' institutes, and other organizations with which the college is accustomed to work, regarding the changes required to improve and perfect our system of public education.

The movement for the introduction of the industrial element into our public schools generally is already well under way. The elements of mechanic arts (including domestic arts) and the elements of agriculture (including what is commonly called nature study) are now taught in hundreds of public schools in different parts of the United States. In more than 40 States the teaching of mechanic arts (under the name of manual training or domestic science) in public schools is authorized by law, and the same is true of agriculture in some 30 States.

This industrial instruction has thus far been largely confined to the city schools, but is now spreading to the villages and even to the country districts. To secure a much wider recognition of the industrial element in public education, an active propaganda by its advocates will bring large results within the next few years. In this work the land-grant colleges and the organizations intimately connected with them might well take a leading part.

Turning now to the other side of this question, the land-grant colleges need to take an active part in the establishment of elementary and secondary courses in agriculture and mechanic arts in the public schools, because such courses are required to direct students to these colleges, and to prepare them to enter the college courses in these institutions. Many of the land-grant colleges are already embarrassed by the rapidly growing influx of students not well prepared to enter courses in agriculture and mechanic arts, if these courses are of a grade strictly equal to those offered in the sciences and humanities. Thus far the demand for industrial education in the land-grant colleges has been largely met by preparatory and special courses of low grade or by keeping the general requirements for admission down to a comparatively low level. This has led to many embarrassments as regards funds, equipment, teaching force, degrees, etc. Following the general course of development of American colleges and universities, the land-grant institutions are more and more endeavoring to raise their entrance requirements and make the requirements for degrees accord with the standards established by our oldest and best colleges. To do this successfully the land-grant colleges need to have many secondary public schools as feeders, and also to satisfy the rapidly growing demand for industrial education of lower than college grade, which is even now causing so much embarrassment to the colleges, and which in the near future they will not be able to meet at all.

In his recent inaugural address, President James, of the University of Illinois, called attention to this as related to the further progress of that university, and used the college of agriculture as a specific illustration of this point. Ten years ago the University of Illinois had in all its departments about 600 students, now it has 4,000. With the same rate of growth for another decade it would have in 1915 over 25,000 students. The college of agriculture in 1895 had less than a score of students, now it has over 400. With a population of, perhaps, one and one-quarter millions in the farm homes of the State 5,000 or even 10,000 students may soon be clamoring for admission to the college of agriculture of the University of Illinois, especially if its terms of admission are kept as liberal as at present.

No wonder President James is alarmed at such a prospect with the impossible burdens which it would impose on the president and the agricultural faculty. His remedy naturally is the raising of entrance requirements and the establishment in different parts of the State of secondary schools with agricultural courses. Such schools, individually maintained without great expense, might give the university properly prepared agricultural students and at the same time turn back directly to the farms of Illinois thousands of young men and women with an enthusiasm for country life and a hopeful outlook toward a progressive and profitable agriculture, because they had been brought into vital touch with the great movement for the application of science to agriculture and the domestic arts, and had obtained at the same time a better training in language, mathematics, science, history, music, and drawing than the common schools afford.

The trustees, presidents, and faculties of land-grant colleges generally would in my judgment do well to follow in the same line of thought and effort on this matter as is being pursued by President James and his associates, and I judge from what I have heard and observed of late at the land-grant colleges that many of them are either working or planning to work in this direction.

John Hamilton, of the Office of Experiment Stations, presented the following paper:

THE "OPEN DOOR" FOR THE LAND-GRANT COLLEGE—THE FARMERS.

THE LAND-GRANT COLLEGE—ITS COMMISSION.

Its commission is "*to teach.*" Teach whom? Teach what? Including military tactics, to teach the industrial classes such branches of learning as will educate them liberally and practically for the pursuit of agriculture in its various departments and of the mechanic arts.

After having adequately provided for instruction in these two classes of industrial pursuits, then if any funds derived from the land-grant act remain, or if the institution has funds from other sources, such funds may be used for the giving of instruction in "other scientific and classical studies" in order to fit men for the "professions" in life.

The supplemental Morrill bill of 1890 directs that the funds received under its provisions shall "be applied *only* to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, *with special reference to their applications in the industries of life*, and to the facilities for such instruction."

This act not only cuts out all language studies except English, but it also emphasizes the important fact that such mathematical, physical, natural, and economic science studies as are taught shall be taught, not after the old traditional manner, but in an entirely new way, with "special reference to their applications to the *industries*." What industries?

The title of the bill indicates the "industries" intended to be included. It declares the purpose to be "to apply a portion of the proceeds of the public lands to the more complete endowment of the colleges *for the benefit of agriculture and the mechanic arts*." It does not say "and for the other industries and professions in life," but stops with the two great industries that were to be the leading objects of education, as indicated in the act of 1862.

This act of 1890, coming as it does twenty-eight years after the founding of the land-grant colleges, is in the nature of a definition or declaration of purpose of the act to which it is a supplement. Some of the colleges had used the funds of the original grant to teach mathematics, physical, natural, and economic science, together with language studies, in a way that directed men into professional life, or at least that did not lead them into industrial pursuits. This act of 1890 distinctly prohibits such use of its funds, and by inference applies the same restriction to the original act, at least until the two leading industries—"agriculture" and the "mechanic arts"—have been fully provided for.

But why refer to this that ought to be, and doubtless is, familiar to every land-grant college officer? Simply by way of reminder of the fact that a "door," wide and open to agriculture, was provided for by both of these national laws, and was directed to be swung in the front portal of every institution that accepted the grants which these two acts of Congress bestowed.

That there is need of such a reminder is evident from the practice of some of the land-grant colleges in their distribution of the funds received under the Morrill Act, as shown in their reports to the Bureau of Education of the United States. The reports for the year ended June 30, 1903, the last published, show that the colleges that year varied in the amount which they assigned to agriculture out of the $25,000 received under the Morrill Act from less than $5 in one instance to over $14,000 in another. The general average given for agriculture out of this fund by all of the institutions was 16 per cent and for mechanic arts 28 per cent. By omitting four institutions giving the highest amount to agriculture, the percentage assigned to agriculture by the remainder is reduced to 13.35, and if five of the next highest are likewise omitted the percentage will be but 11.6.

By taking twelve institutions appropriating the least to agriculture, representing an income that year from the Morrill fund of $289,286.76, the amount given to agriculture is 3.75 per cent and 31.75 per cent to mechanic arts. On the other hand, taking the four highest in appropriation to agriculture that year, we have, in a total of $104,494.16 received under the Morrill Act, 44.9 per cent appropriated to agriculture and 20 per cent to mechanic arts. If, therefore, the apportionment of this fund is at all indicative of the distribution of that of the act of 1862, then we have exhibited the varied interpretations which the land-grant colleges place upon the language of the two acts of Congress so far as making education in agriculture their leading object is concerned. In short, we have their view of their obligations to open the door to agriculture as agriculture is now defined by the Bureau of Education of the United States, which includes agriculture, horticulture, forestry, agronomy, animal husbandry, dairying, veterinary science, poultry industry, and apiculture.

We also have their view as to the relative importance of education in agriculture as compared with education in the mechanic arts. That there is wide divergence of view in these respects among those whose duty it is to administer this trust is thus manifest. As a consequence we find that the door of agriculture in some of the land-grant institutions is out in front and is flung open wide, while in others, as the figures show, it is found in rear and is set ajar just far enough to provide for moderate ventilation without causing a draft.

THE LAND-GRANT COLLEGE—ITS OPPORTUNITY.

The land-grant college of to-day stands at an "open door." It has been let down in the midst of 28,000,000 of agricultural people. The educational needs of farmers were never greater than they are to-day. The power to aid stored up in the land-grant institutions was never better adapted to meet country needs than it is to-day. The barriers that once divided science from practice are almost completely broken down. The gates of agriculture, once barred by prejudice against college training, are now wide open.

What more can the land-grant college wish? An "open door" is all that the gospel message has ever asked. "Free entry" is all that legitimate commerce seeks. "Opportunity" is the only advantage that a capable man desires.

Applying the truth that opportunity carries with it corresponding responsibility, the land-grant colleges stand in the midst of the American people responsible for their agricultural salvation. They were created for their deliverance; they were endowed for this; they ought to be officered and equipped and administered for this end.

However much they may have done in the past or may in the future do for the aid and elevation of men in their several pursuits and professions in life, they have signally failed of the main purpose of their creation if they have neglected to do for farming people not all that farming people need but all that modern knowledge in agricultural science has made it possible for them to do.

What shall they do for farmers? From the "open door" of opportunity there lie in plain view three great fields, for whose cultivation the land-grant college was designed.

FIELD I.—THE COLLEGE CLASS ROOM.

(a) *The four-year course.*—For the education of young men and young women for teachers of agriculture, for scientific investigators in agricultural subjects, and for experts to take charge of agricultural enterprises requiring special skill and thorough scientific training—a course the equal in culture value and discipline of the mental powers of any other course.

(b) *The short courses.*—These for students whose circumstances prevent their remaining in college for the full four-year term, and yet who can leave home for portions of one, two, or three years to engage in agricultural study along special lines.

(c) *Postgraduate courses.*—These for advanced study and to qualify for agricultural experimentation and research.

FIELD II.—COLLEGE EXTENSION WORK.

This embraces—

(a) The correspondence school of agriculture.
(b) The farmers' institute.
(c) The movable school of agriculture.
(d) The practice farm.

The obligation of the land-grant college is not restricted to the comparatively few who come to its class rooms, who live within its walls. The great mass of agricultural people live outside. Of what value is an "open door" to a man an hundred miles away chained to his work unless out of that door there come to him messengers of help?

The command to these institutions is to "teach." They have fixed location, but their commission to give instruction is not bounded by classroom walls. They were founded to "promote the liberal and practical education of the industrial classes." Where are these classes? For the most part out at work.

In the past the land-grant colleges have come to the assistance of farmers by fitting their sons in their class rooms for teaching and for pursuing agriculture as a calling, and by equipping them as investigators and expert scientists for service in the agricultural experiment stations and in the National Department of Agriculture. The "open door" to-day looks out upon a much wider field. It extends this obligation to giving aid to the farmer himself. The colleges have recognized this obligation. They have equipped and are conducting correspondence schools and reading courses in agriculture, and they are sending out specialists to give instruction in the institutes.

The correspondence school.—The correspondence school and the reading course in agriculture have benefited many who otherwise would have had little opportunity for self-improvement. They have prepared a literature specially adapted for the farmers' use, and through the selected studies which they have prescribed thousands have been brought to a better understanding of the possibilities of agriculture and have been fitted for its pursuit to an extent far beyond that which would have been possible without this aid. Valuable as they are they fail to arouse the enthusiasm that comes from personal contact with the living teacher.

The farmers' institute.—The farmers' institute has more than any other been the agency through which country people have been brought in contact with college life and college men. What has this intercourse between the college teacher and the everyday worker on the farm accomplished? It has filled the halls of many of these institutions with country youth. It has broken down once for all the barrier that existed between science and this industry, between the thinker in his study and the worker in the field, and has brought both to respect instead of despise or distrust each other. It has begotten between the practical worker on the farm and the investigator and teacher of the experiment station and the college appreciation, a fraternity of feeling and active cooperation, that no educational institution in any other age has been able to effect.

In 27 States and Territories the institutes are wholly controlled by the agricultural colleges and experiment stations. Nine hundred and ninety-two lecturers were regularly employed by the State institute directors for giving instruction during the year ended June 30, 1905. Of this number the faculties of the land-grant colleges and the staffs of the experiment stations furnished 366, who contributed that year 2,646 days of their time to institute teaching. About 1,000,000 persons, chiefly farmers, were met and instructed in the institutes.

Was a wider door of opportunity ever opened to any other set of educational institutions than this which the farmers' institute presents? A door that opens out to a field altogether unoccupied and boundless in its possibilities.

Institute instruction, as it has been given, is however but the kindergarten of what is yet to come. The institutes have shown farming people that there is a large amount of valuable information in existence that would be serviceable to them if they had it, and they have demonstrated that it is entirely feasible to impart scientific information to practical farmers who have never had the advantage of scientific training.

The institute lecture heretofore has been in the nature of a sample of the subject. Not a full presentation, but only a minute portion of the great field that the subject covers. The methods used may be likened to those practiced by manufacturing establishments in their sending out representatives with samples of their goods to exhibit before the purchasing public. The merchant examines the sample, is satisfied as to its quality and adaptability to his trade, sends in an order. In the institute the lecture, as a sample of the subject, has been presented. The hearer is satisfied with the sample; is assured that a large quantity of similar information is in store. He accordingly, like the merchant, desires that he be furnished with an amount sufficient to meet his needs.

At this point the present system fails. As at present organized it can not meet this need. It fails both for lack of time, and from the unwillingness or inability of any considerable number of persons in any community to devote themselves to the study of a subject for a period long enough to become thoroughly instructed.

The movable school.—To meet these conditions and overcome the difficulties which they occasion, a system of "movable schools" has been devised. The plan provides for organizing, in various communities, classes of not less than 8 nor more than 15, the members subscribing to an agreement to attend a course of lectures upon some agricultural subject, continuing for from two to four weeks as the case may be, and to perform such demonstration and practice work as the course requires. The school is intended to be equipped with all of the apparatus needed for instruction in the specialty, and be taught by one or at most by two experts who give instruction upon a single subject.

If the topic, for instance, be "poultry" the entire course would be devoted to that study, pursuing a graded outline, beginning with the elementary principles of poultry rearing, and continuing by progressive steps until its completion, each lecture to be accompanied by a practicum lasting from an hour to an hour and a half, in which all of the students would participate.

Upon the completion of such a course each student would not only have had opportunity to acquire theoretical knowledge of the subject, but would also have actually performed such operations as the practical producer of the product must conduct. The instructor would be expected to visit at least one of his scholars each day, consulting with regard to the improvement of the conditions that exist at his home in the direction in which the instruction is given.

Upon the completion of the course the teacher would move to another center and there conduct a similar school. By this method there would be left in each farming district where the school is held at least ten or twelve persons fitted for doing the things that had been taught, forming a corps of resident practical demonstrators and instructors whose influence, example, and teaching would be constantly at work for the betterment of those among whom they live. These schools can be varied and multiplied according to the needs of the various communities.

In this way continuous instruction could be given throughout the year, and permanent occupation be provided for skilled specialists, to whom there would be opened up a career in institute work that does not now exist.

The practice farm.—The graduates in agriculture in the land-grant colleges lack qualification for taking charge of important agricultural interests by reason of their inexperience in business methods, in the control of labor, and in conducting the details of successful farming. Facilities for developing these qualities, essential in successful agriculture, the colleges now fail to furnish.

If each land-grant institution had under its control from five to twenty or more farms of from 10 to 50 acres each, distributed throughout the State, equipped for carrying on the various operations of agriculture, and would place them in charge of her graduate agricultural students that they might gain experience in the practical operations of farming, a much needed and valuable addition to the present course in agricultural education would be supplied.

The graduates in charge would be under the general direction of the officers of the institution, and would be expected to continue for two or three years, serving at a nominal salary, keeping the books, directing the labor, planning new work, conducting all of the operations, and reporting results.

The farms could be specialized to any extent. One might be devoted to dairying in one or all its branches, another to the breeding or feeding of stock, another to poultry rearing, another to market gardening or to greenhouse products or floriculture, another to horticulture, and some to general farming.

Such practice farms would not only fit agricultural graduates for entering upon their own farms and conducting them successfully, but would also provide a supply of experienced managers for experiment and demonstration work and for the oversight of large estates.

Is it not the obvious duty of the land-grant colleges to occupy these fields in college extension work by organizing their faculties of instruction and otherwise equipping themselves for properly conducting correspondence courses, for engaging more fully in the farmers' institute work, for conducting movable schools of agriculture, and for establishing practice farms, utilizing these agencies for reaching and assisting the great agricultural class, whose liberal and practical education in agriculture they have pledged themselves to promote?

FIELD III.—NORMAL SCHOOLS OF AGRICULTURE.

Experts are needed for:

(a) Farmers' institute instructors.
(b) Teachers in movable schools of agriculture.
(c) Field demonstration work.

There are three sources of supply:

(1) From the membership of the faculties of the agricultural colleges and the experiment station staffs.

(2) From a special force of experts employed by the agricultural colleges as field men, who are also itinerant instructors in agriculture.

(3) From among capable farmers who have notably succeeded in at least one important department of agriculture.

Teachers of the first two classes will necessarily almost all be college-trained men, graduates who have taken the full 4-year course and have had experience as teachers, experimenters, or practical demonstrators in agriculture. The number of such men available for agricultural extension work will always be inadequate. But whether many or few, a normal school would be helpful in training them in the art of presentation and in extension methods.

The remaining resource is to secure from among the most intelligent, capable, and successful farmers such as show aptitude for teaching and give them additional training in the specialty that they have pursued. For this normal schools of agriculture ought to be provided.

A set of normal courses, to continue for several weeks each year, arranged to cover the specialties that extension work in agricultural education is called upon to teach, should be constructed, and faculties composed of expert specialists should be engaged to give instruction. By confining the attention of each normal student to the study of the particular subject that he expects to teach in the farmers' institute much might be accomplished in a reasonable time. A 16-weeks' course, giving 3 hours each day to lectures on a specialty, 3 hours to practical work, 2 hours for reference work in the library and for special reading, and 1 hour for lecture upon some general subject, would amount to 864 hours, all devoted to instruction in the student's specialty, except the 96 hours given to hearing lectures upon general subjects.

Experiments made show that no single State is able at present to establish, equip, and properly conduct a normal school such as extension work in agricultural education demands for the education of its lecturers.

The first practical difficulty is that the number of scholars in any one State entering such a school will be comparatively small, rendering it almost impossible, if they are divided into classes according to their several specialties, to have classes of sufficient size to warrant the expense. The second is that most of the agricultural colleges are not yet sufficiently equipped in their teaching force of experts to do more than cover a quite limited range of topics. The third and insurmountable difficulty is that no one institution can afford to give the use of its teaching force for the length of time needed to make a course effective. If, however, several States were to unite in a normal school to be held at different institutions each year, equipped with a teaching force contributed by each, the difficulties mentioned would be largely overcome.

Interstate normal schools for the instruction of specialists in agricultural extension work, the farmers' institute, the movable school, the practice farm, and the demonstration field would add immensely to the service that the land-grant colleges are now rendering, and would make possible the extension of agricultural instruction to an unlimited degree.

In conclusion, Congress intended to swing wide the door of agricultural education to farming people. If the land-grant colleges will equip themselves and occupy the entire field that agriculture offers for their effort; if they will take advantage of the educational opportunities in aid of agriculture that lie before them, they will do no injustice to any other interest that the two acts of Congress require them to protect, and they will be but fulfilling their obligations to the farming people of the United States.

C. R. VAN HISE, of Wisconsin. I desire to say a word or two in discussion of one of the papers which has been presented, namely, that by President Kerr, of the Agricultural College of Utah. It seems to me that he has outlined what is desirable in those cases where there is a subdivision of the university effort within the State. But I believe that if the statements which President Kerr has made are carried to their logical conclusion, and if they are measured in the light of actual development, but one conclusion can follow where this subdivision exists, namely, that there will be two or three institutions in the State in which both liberal education and practical education are given. There is no such thing as teaching practical education and application of science or the application of knowledge to life, except you base that work upon a broad foundation of pure knowledge. Therefore, one agricultural college after another has been obliged to introduce history, political science, English, or modern languages, and pure sciences in their courses in order to properly teach agriculture. If agriculture is so taught that it is more than manual training, this can not be avoided. On the other hand, the university can not exist in the realm of pure knowledge apart from practical effect. That makes it too theoretical an institution, and too far apart from the life of our people to win their support. The university feature which exists must at various points touch the people, and touch them closely, and therefore the university has superimposed upon these literary courses, upon pure knowledge, various lines of the applications of science, of knowledge, law, medicine, engineering, as well as other applications. Therefore it is impossible to avoid overlapping. Those States which have started out to maintain two or three institutions have started out to maintain an expensive system, but if they maintain it efficiently, if the system gives them the results which they hope to get, they will be obliged to pay the cost, and they must do these things.

It is not necessary that the entire realm of pure knowledge be covered in a college of agriculture. It is not necessary that the ancient languages, that the oriental languages, that biblical literature, that archæology, and those subjects be taken up. It is not necessary in the universities to take up all the fields of applied science, but chemistry, physics, botany, English, political economy, political science, to some extent, and history must be factors of both institutions, and the States that try to maintain the two colleges must pay for that duplication. There is no other way. They must pay for it in laboratories and equipment, and to some extent in men. It is, however, not necessary for each college to do all the work in the applications of science to life. Naturally the university does not cover the field of agriculture. In no case, so far as I know, does the agricultural college attempt to cover the fields of law and medicine. There is the debatable ground of engineering in all its branches, which is distributed between the two, and it should be distributed between the two, as President Kerr has said, in the weaker States, but which in the stronger States will be inevitably developed in both.

I make these remarks because this problem is before some of the Western States. It is still a live issue in some of them. It is my judgment, and most deeply seated, that all States which are yet able to adopt the policy of concentration should do it, because the expense is so great that it is impossible to do the best and have duplication. In those States in which the policy of subdivision has been adopted the best effort ought to be made by the two or three institutions to harmoniously work together for the best interests of the State.

With an expression of thanks to the officers of the section and to those who contributed to the programme, the section adjourned sine die.

SECTION ON EXPERIMENT STATION WORK.

Afternoon Session, Tuesday, November 14, 1905.

The section convened at 3.10 o'clock p. m., the chairman, H. J. Patterson, presiding.

H. J. Wheeler, of Rhode Island, presented the following report:

Report of Committee on Agricultural Federation.

Your committee begs to report that during the past winter a letter was sent to every director in the United States urging him to take such steps as might be necessary to bring about a federation of his State agricultural organizations. It was not expected that the directors should take a directly active part in the promotion of the federations.

The chief drawback to the federation idea in the South and West was found to be a lack of organizations to federate, and in some instances a lack of ready means of railway communication. In two or three States federations were already in existence, and in others they have been formed as a result of this effort.

The following is a list of the States in which federations exist, with the names and addresses of the secretaries:

Name of State.	Name and address of secretary.
Maryland	Asa B. Gardiner, jr., Baltimore, Md., 514 North Calvert street.
New Jersey	Franklin Dye, Trenton, N. J.
New York	T. B. Wilson, Halls Corners, N. Y.
Pennsylvania	H. P. Armsby, State College, Center County, Pa.
Rhode Island	H. J. Wheeler, Kingston, R. I.
Iowa	George A. Wells, Des Moines, Iowa.
Michigan	L. Whitney Watkins, Manchester, Mich.
Texas	J. W. Carson, College Station, Tex.
West Virginia	

The following brief statement sets forth the existing situation in each of the other States as it has been reported to date:

Alabama	Expression favorable.
Arizona	No reply.
Arkansas	No reply.
California	No reply.
Colorado	Favorable, planning for a federation.
Connecticut	Unfavorable to federating.
Delaware	No reply.
Florida	Favorable.
Georgia	Favorable.
Idaho	Favorable to the idea.
Illinois	Unfavorable to federating at present.
Indiana	No reply.
Kansas	Not favorable at present.
Kentucky	No organizations of farmers exist at present, but they are being agitated.
Louisiana	Favorable.
Maine	Favorable, but difficulties to be overcome.
Massachusetts	Unfavorable report.

Minnesota	Unfavorable.
Mississippi	No reply.
Missouri	Favorable; some progress in federating already made.
Montana	May attempt federation the coming winter.
Nebraska	No definite report.
Nevada	Impossible for a year or two.
New Hampshire	Unfavorable at outset, but showing signs of a change of attitude.
New Mexico	No reply.
North Carolina	Action in concert, but no official federation at present.
North Dakota	No farmers' organizations, but favorable to federation.
Ohio	Favorable.
Oklahoma	A practical though not official federation at present.
Oregon	Federation not needed at present.
South Carolina	Indefinite response.
South Dakota	Favorable.
Tennessee	Matter under investigation.
Utah	No reply.
Vermont	Nothing has been done as yet.
Virginia	Being organized at present.
Washington	Federation under way at present.
Wisconsin	Need not felt at present.
Wyoming	No organizations to federate.

While your committee can not report great success in its work, it is evident that a fair amount has been accomplished already in the past year, and that if followed up persistently most of the States may perhaps be led to establish federations.

H. J. WHEELER,
CHAS. D. WOODS,
H. J. PATTERSON,
Committee.

The report was accepted and the committee continued.

SOIL FERTILITY IN RELATION TO PERMANENT AGRICULTURE.

C. G. Hopkins, of Illinois, read the following paper upon this subject:

If the combined efforts of the United States Department of Agriculture and the various State experiment stations result in the discovery, and the ultimate adoption by farmers and landowners, of profitable systems of permanent agriculture, it must forever stand as the greatest achievement in American industry and as the surest guaranty of permanent national prosperity.

Several soil experiment fields are being conducted on the various types of soil in the different sections of Illinois by the Illinois State Experiment Station. At a recent conference of the farmers and landowners upon whose farms these experiment fields are located, the statement was made by one of the gentlemen present that when he was born there was not a mile of railroad in the United States. He was born only twenty-five years after Washington died. These statements help us to realize that America, as a nation, is very young.

This same gentleman, Col. N. B. Morrison, of southern Illinois, stated that he had not only seen the development of the entire American railroad system, but that he had also seen the essential ruin of agricultural lands by regions in these United States.

Are there tracts of land in this new country whose productive capacity has been reduced?

Are there fields in Virginia which once grew great crops of corn and tobacco but which are now abandoned and disowned, so that no man pays taxes upon them?

Are there farms in the famous Mohawk Valley which can now be purchased for less than the farm buildings once cost?

Are there agricultural lands in the Western Reserve which were sold half a century ago for more than $100 an acre, and which can now be bought for less than $50?

Are there farms in Indiana and in southern Illinois whose cash value is less to-day than thirty years ago?

Are those wonderful wheat lands of Minnesota and the Dakotas, where I gathered the buffalo bones from before the plow that turned the virgin sod--are they producing smaller crops of wheat than twenty years ago?

To all of these questions men who know the facts and conditions have answered yes.

In this convention of representatives from American agricultural colleges and experiment stations, it seems not inappropriate even to remind ourselves that, without agriculture, America is nothing.

The forest and the earth supply the timber, the stone, and the metal to build and equip railroad and factory and the fuel to operate mill and locomotive, but directly or indirectly these great industries are absolutely dependent upon agriculture for their continued existence. Without agriculture the forest trees would be left to grow, the coal and iron would remain in the earth, the cities and the railroads would be abandoned, and the people must return to hunting and fishing, the industries which preceded agriculture.

It is true that an intensive agriculture consisting of dairying, fruit growing, and truck farming may be supported by large cities, which, however, derive their support largely from the trade and commerce related to the more extensive agriculture of newer regions.

It is also true that the farm manure produced in Europe from the shiploads of corn and other products from American farms, supplemented by commercial fertilizers, made in large part from American phosphate rock, will materially assist in maintaining the agriculture of some European countries.

We must bear in mind, however, that the United States can never hope to draw upon her colonies nor upon foreign countries for unlimited quantities of food and fertilizer; and even now we must recognize the fact of a decreasing productive capacity of large areas of the best lands in our richest agricultural States.

Are there possible systems of profitable permanent agriculture of unlimited application?

The dairy system of farming, in which only butter is sold from the farm, maintains the fertility of the soil if all other products or residues are properly returned to the land; but the application of this system is exceedingly limited, because the world can not live on butter alone.

If milk or meat is sold and concentrated feeds are purchased, we can not only maintain, but increase, the fertility of the soil; but all farmers can not purchase unlimited quantities of concentrated feeds from their neighbors and make use of the manures thus afforded upon their own farms, nor will the world live upon meat and dairy products only.

Probably 80 per cent of the farmers of the United States sell wheat or corn or cotton, and probably they always will; and let no man presume that he has found permanent salvation for American agriculture until he has provided some adequate means for the profitable maintenance of the productive capacity of those farms which are to supply the world with bread and clothing.

There is a system by which we can keep what we have, a system which may sometime be forced upon America as it has already forced itself upon such countries as China, a system which requires that every farm product be followed to its ultimate consumption and every residue brought back, a system which requires the country women of China to carry their produce to market and exchange it in part for the night soil of the village, which has been carefully saved for its fertility value and which must be carried back to the farm.

May this necessity be far removed from the country of whose fertility we are the guardians!

In considering the question of permanent agriculture, I am not unmindful of the fundamental principle announced by the Bureau of Soils, namely, that "practically all soils contain sufficient plant food for good crop yields," and that "this supply will be indefinitely maintained," toward the demonstration of which some contributions are being made by means of carbon black and other nonnutrient materials in twenty-day pot culture experiments; but this assertion has not yet been proved, and we still feel obliged to accept the more conclusive evidence of such exact sciences as chemistry and mathematics and the scientific experiments of half a century and the practical experience of ages, regarding the possible depletion of the fertility of soils.

It is of course true, in theory, that while the length of a quarter section of land is one-half mile and its width is one-half mile, its depth is 4,000 miles. In practice, however, we are limited to a few feet in depth. There is a depth, varying with different conditions, from below which crops draw less plant food than is lost from above in surface and subdrainage. It is not yet known to what depth we should measure our stock of plant food, but this we know: That the process of oxidation, including nitrification, and of fermentation and decompositon, by means of which plant food is liberated and made available for plants, is limited almost exclusively to a few inches of surface soil.

While our interest in the physical composition should be measured by feet in depth of soil, our interest in the chemical composition may be measured by inches. Given 6 or 8 feet of soil of perfect physical composition, capable of absorbing and retaining moisture to be delivered by capillary action to the growing plants as needed, with 6 or 8 inches of surface soil of perfect chemical composition, and large crops are assured; but of little value is a rich subsoil overlain by a worn-out surface.

The argument is made that immeasurable quantities of plant food are brought from unknown depths by the capillary rise of the soil solution. Considering the facts that rainfall far exceeds evaporation in most humid countries, that subdrainage waters always carry away some plant food, and that old leached soils contain much lower percentages of lime and plant food elements than are contained in similarly formed soils of more recent origin, we conclude that we must not depend upon the supply of plant food being maintained by the rise of the soil solution. As an average of thirteen years at the Rothamsted Experiment Station, the annual loss of nitrogen in the drainage water from a 20-inch gauge, containing 20 inches of soil, was 37 pounds per acre, while from a 60-inch gauge, containing 60 inches of soil, the loss was 36 pounds of nitrogen per acre, or 1 pound less from the 60-inch than from the 20-inch gauge, thus showing that there is a loss and that the loss is from the surface soil.

Another argument which some hold to make ample provision for the indefinite maintenance of the fertility of the soil is the fact that the soil is constantly being mixed to unknown depths by ants, earthworms, crawfish, and other agents. The fact that we have soil and subsoil which are markedly different is sufficient evidence that this mixing process is very limited. Indeed, the composition of the subsurface soil lying immediately below the plow line is usually appreciably different from that of the plowed surface, and not infrequently we find at a depth of 8 or 10 inches a stratum differing markedly in character from the surface soil.

With due respect to Darwin and to his more ardent supporters of this theory, we must conclude that these agents could not be depended upon to permanently maintain the fertility of the surface soil, even if their activities extended to inexhaustible supplies of plant food.

The truly fundamental plant-food questions which probably deserve the most serious consideration are as follows:

(1) To what depth do plants feed significantly in practical crop rotations?

(2) What is the total stock of plant food in the soil to this depth?

(3) How rapidly by practical methods can this plant food be made available?

(4) When necessary, in order to insure the production of large crop yields, how can we most economically supplement the plant food which can profitably be liberated from the soil?

Investigations are in progress in Illinois to determine the depths to which different plants feed under varying conditions, and because of the very great importance of this subject I take the liberty to urge that other experiment stations assist in solving this problem, especially for the soils and crops of local importance, and to suggest that the assistance of the National Bureau of Soils in this line of investigation would be deeply appreciated and probably of great value.

As a rule we all prefer to report upon the actual results of investigations rather than upon the plans or methods of investigations in progress, but it seems not inappropriate, considering the needs and possibilities of solution, to describe one of the methods by which we are attacking this problem.

We take a given soil and enrich it to a certain depth, say 7 inches. In another pot or plat we enrich the second 7 inches of soil; that is, between 7 and 14 inches in depth, and in another pot or plat we enrich the entire 14 inches in depth, using twice the quantity of plant food required for a 7-inch stratum. By growing plants in these soils we are thus able to determine the influence upon plant growth of a rich substratum, not only when the surface soil is poor but also when it, too, has been enriched. By varying the depths and strata to which plant food is applied, the amounts and kinds of plant food added, and the kinds of crops and soils used, the investigation is made to cover a variety of conditions.

Regarding the second question, we do not know as yet what depth of soil should be used in computations relating to the elements of soil fertility, but from what meager data we have thus far obtained I question if, in our common soils and with our common crops, we can draw plant food in significant amounts from depths below 18 inches. In most soils with which I am familiar it has not been found profitable to plow deeper than 7 inches, and because of this I wish first to consider the total stock of plant food in the surface 7 inches of soil; and because I have less knowledge of soil conditions elsewhere I shall confine myself mainly to Illinois soils in this discussion.

It should be understood, however, that Illinois soils are probably as rich as those of other States with similar climate and latitude. This is strongly indicated by the Government statistics relating to the corn crop. About 1,200,000,000 bushels of corn (one-half of the corn crop of the United States and more than one-third the total corn crop of the world) are produced annually in the five States—Illinois, Iowa, Nebraska, Kansas, and Missouri. The State of Illinois, with one-sixth of the combined area of these five States, produces one fourth of this corn. Illinois not only produces more corn than any other single State, but according to the Government averages for the past ten years the yield per acre in Illinois is from 2 to 13 bushels higher than in the other corn-belt States.

Five great soil areas comprise the larger part of the Illinois corn belt. These areas are known as the Middle Illinois Glaciation, the Upper Illinois Glaciation, the Pre-Iowan Glaciation, the Early Wisconsin Glaciation, and the Late Wisconsin Glaciation. More than one-half of the State of Illinois is included in these five soil areas. The principal types of soil in each of these great areas have been carefully investigated, and I shall consider here an average which represents the commonest soil in the Illinois corn belt—soil which in normal seasons produces 60 bushels of corn, 60 bushels of oats, and 30 bushels of wheat per acre, without the use of manure or fertilizers. In discussing the average composition of this soil I shall not consider the element nitrogen, except to say that we do not and can not profitably raise corn on commercial nitrogen, and to remind us that, at commercial prices, there is more than $10,000,000 worth of nitrogen resting on every acre of the earth's surface. Furthermore, there is an actual profit in raising such crops as clover, stock peas, soy beans, and alfalfa for their own value, aside from the value of the nitrogen which they fix. The general farmer may sometimes buy water, but he ought never to buy nitrogen. Aside from its use in intensive farming, as on high-priced land near large cities, the element nitrogen has no justified commercial value.

I wish to consider the phosphorus and the potassium in this Illinois corn-belt soil:

In an acre of this soil to a depth of 7 inches, which is estimated to weigh 2,000,000 pounds, there are less than 1,200 pounds of phosphorus and more than 36,000 pounds of potassium. If we could draw upon this plant food for 100 bushels of corn each year, the phosphorus would be entirely exhausted in less time than is measured by the life of one such man as Col. N. B. Morrison. The second 7 inches of soil contains less phosphate than the first, for our rich, loamy soils contain in the surface stratum some organic phosphorus, a part of which has certainly been brought from the second 7 inches by the vegetation which has grown during past centuries.

The 36,000 pounds of potassium contained in the first 7 inches of soil are sufficient to supply potassium for a 100-bushel crop of corn each year from the birth of Christ until the present time, assuming that the grain only is sold from the farm. In the second 7-inch stratum the supply of total potassium is sufficient for another 1900 years. If the surface of the soil is washed away so that the general level of the cultivated land is lowered at the rate of 1 inch in 300 years, then our supply of potassium is absolutely permanent for a system of practical agriculture of unlimited application.

Regarding the third question, it should be noted that much ignorant and unjust criticism has been offered because the chemist is not able to determine at any given time how much available plant food the soil contains and how much the next crop will be able to secure from the soil, and because different chemists have employed different methods in trying to get some measure of the plant food which is likely to become available some time, but have not found any one method which gives all of the information desired.

The soil-fertility question in which mankind is most interested is not, How much so-called available plant food does the soil contain at any given moment? but rather, How much total plant food does the soil contain and how can we best make it available? By chemical methods, and by no other, can we ascertain the total stock of plant food in the soil to any given depth. Chemistry may also aid in a study of the probable rate of availability. Thus, if I may offer an illustration, we find that the ordinary brown silt loam soil of the Illinois corn belt in the Early Wisconsin Glaciation contains in the surface soil twice as much potassium soluble in hydrochloric acid as is contained in the gray silt loam soil of the Illinois wheat belt in the older Lower Illinois Glaciation, although the total potassium content of the soils in these two great areas shows no such proportionate difference. Thus, chemical analysis plainly indicates that potassium in the one soil will be made available much more readily than in the other; and in actual practice we find that the application of commercial potassium to the one soil produces no increase in the corn crop, whereas when applied to the other soil potassium increases the yield of corn by 50 per cent, amounting to 20 or 30 bushels increase per acre under favorable conditions.

How to liberate from the soil's inexhaustible supply sufficient potassium to supplement that which can be returned in farm manure, and thus meet the needs of maximum profitable crop yields, is one of the problems to be solved in a system of permanent agriculture. We are still hoping that this may be accomplished by means of decaying organic matter, and to this end we are using not only all available farm manure but also green manures, especially nitrogenous green manures from legume crops.

The fourth question relates to the addition of commercial plant food, when necessary, to supplement that which can profitably be liberated from the soil's supply.

The truck farmers of New Jersey will do well to follow the teachings and experiments of their agricultural experiment station and make liberal use of commercial nitrogen, and thus hasten the maturity, improve the quality, and increase the yield and value of their market-garden crops, even to the extent of $180 per acre, as Director Voorhees has done at New Brunswick; but for the general farmers of America to try to raise 2,500,000,000 bushels of corn with 16-cent nitrogen, at an annual cost of $400,000,000, is not only absurd but it would be impossible, for there is no adequate commercial source for such supplies of nitrogen. All of the information thus far obtained justifies the conclusion that for the general farmer who practices a suitable rotation of crops and makes proper use of legume catch crops and of manure which may be produced on the farm the purchase of commercial nitrogen is both unnecessary and unprofitable. Well-inoculated legume plants will thrive even in soils devoid of nitrogen if they are well provided with lime and the mineral elements of plant food. There is no great nitrogen problem, for it was solved by Hellriegel and Atwater and others more than fifteen years ago.

On some soils of limited extent, as the peaty swamp lands and some sandy lands, applications of potassium must be made. This may be in the form of farm manure produced from crops grown on lands rich in potassium, or commercial potassium salts from the German mines may be used; but on our normal agricultural lands of glacial origin, with a supply of total potassium in the plowed soil sufficient for large crops of grain for twenty centuries and with subsurface and subsoil equally rich in potassium, the corn and wheat belt has no great potassium problem except to liberate that element as needed from the soil. I can not speak for the cotton-belt soils nor for those which are required to grow tobacco, but it seems noteworthy that by the ultimate analysis of 48 samples of Maryland subsoils, comprising 12 different soil formations, Veitch found that the general average composition of normal soils in these 12 formations[a] shows less than 1,200 pounds of phosphorus and more than 33,000 pounds of potassium per acre for a 7-inch stratum assumed to weigh 2,000,000 pounds. This agrees very closely with the average composition of Illinois surface soils.

So far as can be ascertained from the analytical data at hand and from the use of commercial plant food in agricultural practice, the more common glacial loessial, and residual soils of the United States contain an immense store of total potassium and a very limited amount of phosphorus. There are of course notable exceptions, such as the famous "Bluegrass regions" of Kentucky and Tennessee, which are thought to bear some relation to the natural phosphate deposits in that section, where some soils exceedingly rich in phosphorus are found. Attention is called to the fact that three-fourths of the potassium required for a crop of corn or wheat remains in the stalks or straw used as feed or bedding, and when the grain also is fed to animals practically all of the potassium is recovered in the liquid and solid manure.

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[a] Four other formations, including sandy truck soils and sand and other barren soils reported by Veitch, are omitted from this average.

If there is a single key to America's permanent prosperity it is the element phosphorus.

Phosphorus is the element of plant food which already limits the productive capacity of at least 80 per cent of our best agricultural soils, judging from all available information. Fifty-one crops of corn yielding 100 bushels of grain and 3 tons of stover would require the total phosphorus contained in our average corn-belt soil to a depth of 7 inches. Three-fourths of this phosphorus remains in the grain, and thus leaves the farm if the grain is sold. If the grain is fed to meat-producing or milk-producing animals, one-fourth of the phosphorus in the food consumed must leave the farm in the animal products, butter alone excepted.

How are we permanently to maintain in American soils a sufficient supply of phosphorus to insure profitable crop yields? Is not this the greatest question that now confronts the farmer or the experiment station or the American nation?

We obtain phosphorus from basic slag in excellent form, but the total amount of phosphatic slag produced or likely to be produced in this country is almost insignificant compared with present or future needs.

The total supply of bone would be required to maintain the live-stock farms, even if it were all returned to the land from whence it came; but at the present time most of the bone produced in this country is used for other purposes than to fertilize the land. Steamed bone meal, which contains one-third more phosphorus than raw bone and sells at a lower price per ton, is, however, one of the most satisfactory forms of phosphorus for soil improvement.

The natural rock phosphate deposits of the United States, chiefly in South Carolina, Florida, and Tennessee, are believed to be among the most extensive in the world. They, too, like the fertility of American soils, were once thought to be inexhaustible, but now it is known that the visible supply of high-grade rock will be exhausted in less than fifty years if the present rate of increase in consumption continues.

More than 1,500,000 tons of this phosphate rock are annually removed from our deposits and more than 1,000,000 tons, or two-thirds of the entire product, are annually exported to foreign countries. The phosphorus contained in this annual export is sufficient for 1,500,000,000 bushels of corn, or half the annual corn crop of the world. Is not this exportation America's greatest crime against her own posterity? We can make bricks without straw but we can not grow corn or wheat or cotton without phosphorus.

And what is being done with the 500,000 tons of rock phosphate which is not exported? A ton of this raw rock, containing say 250 pounds of phosphorus (sufficient for 1,500 bushels of corn), which is worth about $4 at the mine and which can be delivered to Illinois farmers for about $8, is commonly mixed with a ton of sulphuric acid, thus making 2 tons of acid phosphate, containing 60 per cent of manufactured land plaster and only 125 pounds of phosphorus per ton. The acid phosphate can be purchased by the farmer for $16 a ton, or $30 for the same amount of phosphorus as is bought for $8 in the raw state; but as a rule 2 tons of acid phosphate are mixed with 2 tons of "filler" or "make-weight," usually containing a small amount of nitrogen and potassium, and thus we have 4 tons of so-called "complete fertilizer," the famous 2–8–2 goods,[a] containing 62½ pounds of phosphorus per ton, and selling at retail in the Central States for about $20 per ton, or $80 for the 4 tons of material containing no more phosphorus than 1 ton of raw rock which can be bought for $8.

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[a] By 2–8–2 goods is meant a "complete" fertilizer guaranteed to contain 2 per cent of ammonia, 8 per cent of "phosphoric acid," and 2 per cent of potash, or, on the basis of actual plant food elements, 1⅔ per cent of nitrogen, 3½ per cent of phosphorus, and 1⅔ per cent of potassium. For a 100-bushel crop of corn it would require 660 pounds of this fertilizer to supply the phosphorus, 4,300 pounds to supply the potassium, and 9,000 pounds to supply the nitrogen.

One commercial fertilizer company advertises fourteen brands essentially of this composition. This company advises farmers that "these brands will be best on almost any soil," and especially recommends them for corn, oats, wheat, and cotton. The average composition of these fourteen brands is as follows: Nitrogen, 1.5 per cent; phosphorus, 3.9 per cent; and potassium, 1.3 per cent. These amounts of nitrogen and potassium are too small to justify consideration by the consumer. If the phosphorus is worth 10 cents a pound, the average value of these fertilizers would be $7.80 a ton, although the same amount of phosphorus can be bought for $2.50.

Is it any wonder that farmers who use "complete fertilizer" can not afford to apply it in sufficient amounts to positively enrich their soils; that they must apply it for its effect on a single crop, and that they must depend upon the small amount of phosphorus added, together with that which the soil would naturally give up and that which the stimulating action of the land plaster forces the soil to liberate, in order to make a temporary profit? Is it any wonder that essential land ruin follows such a system?

Experiment-station men everywhere advise against the use of manufactured complete fertilizers, and some experiment-station men advise against the use of acid phosphate. Why should we pay $80 for 4 tons of "complete fertilizer," or even $30 for 2 tons of acid phosphate, for the same amount of phosphorus as we can buy for $8 in 1 ton of finely ground natural-rock phosphate?

Some will answer that the raw rock is not readily available. This is true, but it is also true that it is the business of the farmer to make it available by means of decaying organic matter, the same means by which he makes available the insoluble potassium and the raw-rock phosphate naturally contained in the soil.

As an American, as an investigator, and as a farmer, I thank Director Patterson, of Maryland, and Director Thorne, of Ohio, who planned systematic experiments, to cover many years, to ascertain whether finely ground natural rock phosphate could be made available by turning it under with decaying organic matter, such as farm manure or green manure from legume crops.

Before we had begun the general investigation of Illinois soils, Patterson had some good evidence that when turned under with crimson clover raw rock phosphate is as valuable as bone meal, and Thorne had demonstrated that when used in intimate connection with farm manure rock phosphate is much more profitable than acid phosphate, on the basis of money invested.

The Maryland station now has eleven years' records and the Ohio station has nine years' records in these investigations.

Some of the Illinois plat experiments in soil investigation have been conducted systematically for twenty-nine years, and probably furnish the longest continuous history of any such experiments in the United States, but the Illinois experiments with rock phosphate, although extensive in scope, were begun too recently to afford much data. It may be stated, however, that where we have used finely ground natural rock phosphate in direct comparison with equal money values of steamed bone meal, both being applied in connection with decaying organic matter, we have thus far obtained a larger average increase with the rock phosphate.

So far as I can learn, whoever has persistently tried the use of liberal amounts of finely ground rock phosphate, in connection with abundance of decaying organic matter, has obtained results beyond his expectations, while those who have tried 50 cents' worth of rock phosphate in comparison with two dollars' worth of acid phosphate, usually for a single year, and without any provision for decaying organic matter, have condemned the rock phosphate.

How long will American farmers continue to pay $80,000,000 a year for fertilizers containing less total phosphorus than we export to Europe for $4,000,000 received at the mine, and which for $8,000,000, or one-tenth of our present national fertilizer bill, could be delivered to our farmers in finely ground natural rock phosphate?

Two dollars an acre is not counted a large bill for complete fertilizers, but $2 an acre would pay for a ton of raw rock phosphate delivered in Illinois every four years, and this application would actually double the total phosphorus content of the plowed soil of the Illinois corn belt in twenty years' time.

This would provide a system of permanent agriculture, limited only by the limit of our natural phosphate deposits. We hope for the discovery of still greater deposits of phosphate rock; but unless such discoveries are made, we must use high-grade rock while it lasts; then we must use the lower grades, of which there are some large deposits; and finally we must work over the old dump piles, in order to store our lands with phosphorus; and then we must guard that supply, using it for the production of crops and returning it again to the land in every possible recoverable residue.

The American farmer is still prosperous on our new rich lands, and there is no need of any sensation, but there is need for sense and for the greatest possible simplicity, in order that the people whom we serve may understand.

Crop yields in bushels per acre of Bloomington soil experiment field, conducted by the University of Illinois.

[Prairie soil: Brown silt loam, Early Wisconsin Glaciation.]

Plant food applied.	1902, corn.	1903, corn.	1904, oats.	1905, wheat.
None	37	60	61	29
Nitrogen	35	60	70	31
Phosphorus	42	73	73	39
Potassium	38	56	63	33
Nitrogen, phosphorus	44	78	85	51
Nitrogen, potassium	40	59	66	30
Phosphorus, potassium	50	75	70	38
Nitrogen, phosphorus, potassium	53	81	91	52
Average gain for nitrogen	1	4	11	6
Average gain for phosphorus	10	18	15	14
Average gain for potassium	[a] 6	0	0	1
Average gain for phosphorus when added to nitrogen	11	20	20	21
Value of this increase	$3.85	$7.00	$5.00	$14.70

[a] Steamed bone meal used on this field.

Approximate cost of 25 pounds of phosphorus.

In rock phosphate	$0.80
In steamed bone meal [a]	2.50
In acid phosphate	3.20
In complete fertilizer	8.00

I ask your attention to this tabular statement, which gives the actual crop yields obtained during the first four years on one of our regular soil-experiment fields in central Illinois on typical corn-belt soil.

Each plat is 2 by 16 rods, and contains exactly one-fifth acre. The results are given in bushels per acre. The plant-food elements applied per acre per annum are as follows:

Nitrogen, 100 pounds, at a cost of $16, in 700 pounds of dried blood, which is sufficient for less than a 70-bushel crop of corn.

Phosphorus, 25 pounds, at a cost of $2.50, in 200 pounds of steamed bone meal, which is sufficient for more than a 100-bushel crop of corn.

Potassium, 40 pounds, at a cost of $2.50, in 100 pounds of potassium sulphate, which is sufficient for less than a 60-bushel crop of corn.

As an average of all tests during the last three years, an investment of $16 in dried blood has yielded a gross return of $2.78; an investment of $2.50 in steamed bone meal has returned $6.62; and $2.50 invested in potassium sulphate has returned 23 cents.

During these three years we have applied 300 pounds of nitrogen. We have actually removed 287 pounds of nitrogen from our best-yielding plat—120 pounds in the corn, 83 pounds in the oats, and 84 pounds in the wheat—so that if there has been no loss of nitrogen from the soil by leaching, our account shows a gain of 13 pounds of nitrogen in the soil and a loss of $39.65 in money. Measured by the increase in crop yields on this soil, the actual value of the nitrogen, which costs 16 cents a pound, is less than 3 cents.

In the account with potassium we have applied 40 pounds a year, or 120 pounds in three years. From our best-yielding plat we removed 58 pounds in the corn, 59 pounds in the oats, and 59 pounds in the wheat, making a total of 176 pounds removed. In balancing this account we find two net losses, one amounting to 56 pounds of potassium from the soil, and the other $6.80 in money. Measured by the increase in crop yields, the potassium applied has been worth 0.6 cent a pound, or one-tenth of its cost, which was 6¼ cents.

In our phosphorus account we have applied 25 pounds a year, or 75 pounds in the three years. We have removed 19 pounds in the corn, 13 pounds in the oats, and 13 pounds in the wheat, and our balance shows two net gains—30 pounds of phosphorus in the soil and $12.35 in money. The phosphorus, which costs 10 cents a pound in steamed bone meal, has already returned 26½ cents a pound in increased crop yields, and 40 per cent of the phosphorus applied still remains in the soil.

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[a] Potassium is applied as a soluble corrosive salt which, like common salt, may sometimes act as a temporary stimulant and liberate some phosphorus or nitrogen from the soil.

In closing, I wish to emphasize the opinion of myself, and surely of you who have had longer experience, that no man is justified in drawing conclusions from one year's work with pot cultures or field experiments; and to call your attention to the fact that the results shown in this table are the actual yields obtained without any corrections; that they are from only one of our soil-experiment fields, of which we have more than twenty in various parts of the State, from near the Wisconsin line almost to the Ohio River; and that the results which I have given in detail, while they furnish some of our most decisive data, are yet in harmony with the general average of all results on similar soils, and not only with other plat experiments and field trials, but also in harmony with pot-culture experiments and with the chemical composition of the soil.

H. J. WATERS, of Missouri. Have you been able to see the gain the first year from the application of finely ground rock?

C. G. HOPKINS. A good many of our experiments with the ground rock began this year. Last year, as an average of 16 tests where we applied ground rock without any organic matter, we made a gain of 4.6 bushels per acre; where we applied it with stable manure we made a gain of 8.6 bushels above that made by the rock phosphate without the organic matter.

H. J. WATERS. I would like to ask Doctor Armsby if he has computed the results of the experiments that have been made with unacidulated rock at the Pennsylvania station.

H. P. ARMSBY, of Pennsylvania. Those experiments ran three or four rotations and were then discontinued. They showed no material superiority of the soluble over the insoluble phosphates.

A MEMBER. Why is it that the nitrogen gave increasingly larger results when used year after year with the phosphorus?

C. G. HOPKINS. Where we were using phosphorus without nitrogen the nitrogen would run down in the soil, because no legume crops had been used. It is very necessary to make annual applications of nitrogen in order to keep up the nitrogen in those soils. It is an element the supply of which will be exhausted quickly if we do not take some measures to preserve and maintain it. Phosphorus, however, is the controlling element, as you will see from the averages. We can not draw any conclusions from a single yield on a single plat, but the averages from four different tests show that the first year nitrogen produced an increase, each year the increase growing larger, until in the fifth year it was 6 bushels of wheat.

Potassium produced the first year an average of 6 bushels of corn to the acre, and if we needed any further evidence that would add a little more strength to the statement that we must not draw any final conclusion from one year's work, it is quite evident to me that the action of this potassium salt was a corrosive action. We know that common table salt will increase the yield of many lands for several years, but the result is not permanent. And here the average of the tests for the four years shows that more potassium was not needed in this case.

I would say that potassium frequently produces an injurious effect; that its use as often results in a decrease as in an increase.

R. J. REDDING, of Georgia. I discovered fifteen or sixteen years ago in my first experiment on our soils that potash in any form containing chlorin was oftener injurious than beneficial, and we try now to be very particular never to apply an excess of such salt.

C. G. HOPKINS. I might say that where our soils are very low in available potassium we apply potassium as we did in this soil and get marked increases. On our peaty and swamp lands we apply not less than 100 pounds or perhaps 200 pounds per acre of potassium sulphate or muriate. We have increased the yield from 4 or 5 bushels per acre up to 70 bushels. Those lands are exceedingly low in that element, although they are the richest soils in nitrogen and phosphorus.

Some of our southern Illinois soils which are low in available potassium, also give us a marked increase in corn and cowpeas, and also in clover, with potassium, and heavy applications of it.

In all our experiments calcium carbonate is used. We assure ourselves that we have it in the soil. We always add lime, if necessary, to correct the acidity of the soil.

B. C. **Buffum**, of Wyoming. I think the Wyoming station threw some light on the reason for the reduction of the crop by the addition of the potassium salt by its work with alkali soil. I was very much interested in Dr. Wheeler's late bulletin on the use of sodium salts, but I think he would have found a great deal of difference if he had used the sulphate instead of the chlorid in those experiments. We have found that the reduction of the germinating power of the seeds and the growth of plants seem to be proportional to the osmotic pressure of the solution when these salts are added, and the chlorid always produced more effect than the sulphate. I have always obtained negative results in fertilizer tests on Wyoming soils with potassium chlorid, and some reduction with sulphate. There seems to be plenty of the chlorid associated with the alkali in those soils, and if we add the potassium in this form it reduces the yield.

H. P. **Armsby**. Doctor Hopkins's paper was on the very important question of the maintenance of the fertility of the soil on a large scale. I do not rise to discuss the question or to criticise what has been said, but to suggest that this seems to me to be the very kernel of his paper, and personally I would be glad to hear discussed the question of the maintenance, on a large scale, of soil fertility.

R. J. **Redding**. Several days ago I was asked by a farmer what was the value of the phosphoric acid, potash, and nitrogen in an acre of average Georgia soil. I happened to have at hand an analysis of such a soil and I made a calculation of the amounts of the different ingredients in available form at the market prices. The result was over $1,900 an acre. I think it might help us to impress on the farmers the importance of developing the amount of plant food in the soil to know that $1,800 or $2,000 worth of it is within easy reach of the farmers and what are the methods and what are the tools and implements which may be used to develop it.

W. M. **Hays**, Assistant Secretary of the U. S. Department of Agriculture. I am very much interested in the discussion. I want to especially call attention to one or two relations of this paper to the work that Doctor Hopkins is doing in Illinois. One is the division of the State into these soil and agricultural areas and the following out of the detailed study of chemical facts and relations with schemes of organizing farms on a system of rotation. I think his scheme of analyzing the general situation of the whole State and working up schemes of farm management that will enable the farmer to see best how to keep up the fertility of his land and increase the yield of his crops so that he will have the maximum crops, and yet retain the fertility of the land, should be studied by all.

C. E. **Thorne**, of Ohio. The experience of the Ohio station would seem to me to bear strictly upon this paper. The station purchased three adjoining farms lying on the same general geological formation. The soil, so far as superficial examination would indicate, originally was practically, if not identically, the same. On one of these farms, for the last seven years, one-half of the soil having been cleared from the original forest for this work, we have maintained an average yield of wheat, without any fertilizer whatever, of 35 bushels to the acre. We have been able to increase that yield by the addition of acid phosphate alone to 42 bushels per acre as the average of seven years. We have not been able to increase it any further by any addition of nitrogen, or potassium, or both. On another of these farms, which had been subjected to exhaustive husbandry before it came into the possession of the station, the average unfertilized yield of wheat has been between 8 and 9 bushels to the acre. Where acid phosphate has been used on this exhausted soil it has raised the yield for the seven-year period to about 18 bushels to the acre, and we have been able to raise it by the use of acid phosphate, potassium, chlorid, and sodium nitrate to 29 bushels to the acre. I mention this to bring out the point that experiments made on unexhausted soils may give a very different result from those conducted on old and exhausted lands, and we must take that fact into consideration in our advice to the farmers of the State. It is paying us, on this exhausted land, to purchase nitrate of soda for the purpose of growing wheat and corn and oats, but we are trying to teach the lesson there in Ohio that nitrogen may be obtained infinitely cheaper by the growing of leguminous crops and saving the barnyard manure. Therefore we join Professor Hopkins heartily in saying that no farmer can afford to purchase nitrogen in the form in which we find it in these so-called " complete fertilizers," notwithstanding the wonderful effect such fertilizers are producing on this exhausted land.

H. P. **Armsby**. I suppose Pennsylvania has the oldest experience in plat experiments, and our results there fully confirm the experience of Professor Thorne and Professor Hopkins, in so far as the economic feature goes. Our soil is formed of disintegrated limestone. We find a marked increase of production from the use of nitrogen, applying about 120 pounds to the acre. But this increase is in no instance, I believe, a profitable increase. With potash on our soil we get more marked results than Doctor Hopkins reports upon his soil, but with the nitrogen the results fully confirm his, so far as the profit is concerned, on a soil of probably rather more than average fertility.

William P. **Brooks**, of Massachusetts. The experiments in the Hatch experiment stations have been on soil which had been subjected to cultivation possibly longer than most of the soils which have been referred to, and I rise to make two or three points clear, if possible, in connection with the results upon one field where we have followed a system of fertilization, similar at least in outline, to, though differing in detail from that to which Doctor Hopkins has referred. These experiments have occupied a field that had been in grass a good many years without manure. This was broken up in the spring of 1889 and planted to corn. The average yield of four nothing plants was at the rate of about 30 bushels to the acre. It was replowed in the fall and replanted in corn the next year, and gave a yield at the rate of about 40 bushels to the acre, without manure or fertilizer. Those same four nothing plats have been left without manure or fertilizer ever since, and we have followed a general rotation for the last seventeen years, including in the seventeen years eight corn crops, while the land has been seeded to mixed grasses and clover twice. Each time it remained in grass two years and each year it was mown twice. Now at the present time the plats in that field which have not received manure or fertilizer in all this period yield what, by courtesy, I call about four bushels of shelled corn to the acre—at that rate. I say " by courtesy " because I figure bushels not by shelling, but by weight, and call 80 pounds at husking time a bushel. But the crop on these plats was practically all " nubbins "—there was really no corn there. This land, then, has produced, and will now produce, after sixteen or seventeen years without manure or fertilizer, three or four bushels of corn to the acre. We have had one plat in that field which every year throughout the seventeen years has had an application at the rate of 160 pounds of muriate of potash per acre, and the last time that plat was in corn the yield was between 49 and 50 bushels of shelled corn to the acre. Another plat to which we have applied nitrate of soda annually at the rate of 160 pounds per acre gave us a yield of corn scarcely more than the nothing plats.

Potash alone, or in any of the combinations—and we used it in the same combinations as Doctor Hopkins—increased the crop in a marked degree every time.

One of the first points I want to make is to support Doctor Hopkins in his position that in the case of general farm crops the farmer need not purchase nitrogen. In proof of that I point to the result on the plat which every year during the seventeen years has had muriate of potash and dissolved boneblack—that being the phosphate we have used. The last time that plat was in corn it gave a yield at the rate of 56 bushels of shelled corn to the acre, while the other plat which had received the same quantities of potash and phosphorus, and in addition nitrate of soda, every year at the rate of 160 pounds to the acre, gave a yield of only a small fraction of a bushel more. The crops were practically identical, after sixteen years. It was one year ago when the land was in corn last. Now, in all that time we have not cultivated a legume by itself. We have not green-manured the land. Whenever it was in grass, it was cut twice annually, and the product all carried away; and still the nitrogen content of the soil has been so kept up that we get this yield of corn, which is very good from our point of view, where for seventeen years we have been using only phosphoric acid and potash.

I would say that the character of the herbage on the plats was as different as it could be. Clover would come up on all the plats, but it would die in a short time where nitrogen and where nitrogen and phosphorus were applied, and would live only where there was potash; and where there had been used constantly phosphorus and potassium only, the product was almost wholly clover. On some soils, of which we have very many, without doubt, in New England, the different elements seem to be so evenly balanced that we can not consider the question of what is required apart from the crop. For it makes all the difference in the world what the crop is. On this very field that I have been talking about potash controls the crop absolutely when it is corn or clover, as you would expect; but when we seed to mixed grasses and clovers, we get an excellent crop of hay on the plat where we use nitrate of soda only, for nitrogen is the controlling element for the hay crop with us, and may very profitably be used for that crop.

If into the rotation a crop like cabbages or turnips is introduced, phosphoric acid is invariably the controlling element. In Massachusetts, therefore, we are not justified in talking about what our soils require apart from the crop; with us it is what the crop requires.

We have raised rye in rotation, and there the nitrate of soda was the controlling element, although the response of the rye was not quite as decisive in favor of any one element as was the response of some of the other crops.

H. J. **Wheeler**, of Rhode Island. We have many soils in our State where, if we would advise our farmers to use fine phosphate rock on certain classes of crops, they would find themselves in bankruptcy before long, simply because those plants, as Professor Brooks pointed out, can not use phosphorus in that particular material readily if the land is in a very exhausted condition. Doctor Hopkins's work, as I understand, applies to the cereals exclusively. But, being a body here representing the whole country, we ought to remember that his discussion is confined to the cereals. I can emphasize what Professor Brooks says. We find that while we have applied no potash to the soil for years, we can nevertheless get a very good crop of redtop, a surprisingly good crop, but you can not get a single plat of clover to grow unless lime and potash are added.

We have tried the clover four years on certain plats, and we could not get good results, and we could not get good results with the Cruciferæ, but when we put on Japanese millet and certain other things, they seemed to thrive. If there is anything in the plant family that is a scavenger I thing it is redtop. It will thrive and give magnificent crops where the turnip and the beet and the Cruciferæ are all absolute failures. Therefore, I say when we are considering these questions we must remember that Doctor Hopkins's conclusions apply to two or three crops, and can not be applied generally throughout the United States, nor to all kinds of crops.

William P. Brooks. As Doctor Wheeler has referred to the question of different phosphates, you may be interested in the results which have been obtained at Amherst in comparing phosphates. We have one field where for twelve years we have been comparing phosphates, on the basis of phosphoric acid, applied of course to all plats equally. With liberal and equal amounts of nitrogen and potash on all. The phosphates under comparison have been raw and steamed bone, raw bone, acid phosphates, dissolved bone, and we have South Carolina and Florida phosphates, and phosphatic slag, and the results vary very widely with the crop. With a crop of cabbages there is a marked difference, and the best results are with acid phosphates and dissolved boneblack, and dissolved bone meal and the slag; and one of the poorest returns is given by South Carolina rock, while the Florida phosphate is no better than nothing. But if we put the field in corn, as we have done, the crops are substantially equal on all the plats in the field. I am now putting that field for the first time into grass and clover, but in general it is the Cruciferæ only that have shown marked difference in their capacity to make use of these phosphates.

W. R. Dodson, of Louisiana. There is one phase, I think, which has not been entered into fully enough in the discussions. It seems to me Doctor Hopkins was looking further into the future than we are ordinarily given to looking. I refer to that phase of his paper that was looking to the duty we owe to posterity; that we should not look at this in the spirit of merely putting something in the soil and getting back from it all that we can, but that we should consider that our children and their children are going to have possession of this soil. We know that by doing certain things we stimulate conditions so that we get more from the soil than if we had not added that stimulant; that we are gradually robbing the soil of elements to an extent we scarcely realize. We want to bring our people to understand that while there is a great supply of nitrogen that we can get by means of the leguminous plants, the supply of bone, and the supply of rock phosphate, so far as we can see, is some day going to be insufficient for the phosphate demand of the crop.

This, then, is the great question, looking into the future: How are we to manipulate these crops in rotation, and how are we to handle our system of fertilization, so that we can hand this soil down to posterity in an unimpaired condition? While we can see our way to furnishing whatever potash or whatever nitrogen we need, so far as we can now see there is danger of the phosphoric acid becoming depleted, and there is no source of supply from which what will be necessary can be furnished.

J. L. Sheldon, of West Virginia. I believe we are getting down to the principles in agriculture which have been so emphasized by Marshall Ward, the English authority from which he deduces the proposition that the plant is the foundation of all work in agriculture; that the soil, the moisture, etc., are merely the environments. We are trying to grow all kinds of plants on the same kind of soils. In other words, we are trying to raise horses on swill, and hogs on straw. Is it not time that we began to study the plant and its food, and how that plant can best get that food, so that we can make a profitable crop? It seems to me that the question is not so much with regard to the soil or the chemistry of the soil, as it is with regard to the plants themselves, and how we can best stimulate these to bring us profitable crops.

C. G. **Hopkins**. There are two different points that have been raised which I would like to refer to for a moment. One of them I might speak of as price, and the other as percentage.

Whether the use of any given material upon our soils for growing crops is economical or profitable depends more largely, than many of us stop to think of, upon the price we allow for that material when it is produced. Even in raising a crop of hay, near some eastern market where that hay crop brings $15 to $20 a ton to the farmer, you can pay anything, almost, for the materials you use to grow that crop; but when you get out into the agricultural regions of the West, where the farmer gets a net return of only $3 a ton for his hay, of course he can not pay much for such materials.

Take the work Director Thorne has spoken of in Ohio; when we figure on the prices that he mentions, using nitrogen and potassium, it paid very well, figuring wheat at a dollar a bushel, corn at 50 cents a bushel, and oats at 33⅓ cents a bushel. But when I have taken the most recent figures from the Ohio experiment stations and applied them to Illinois conditions and considered them in relation to the last ten years, neither nitrogen nor potassium has paid for itself upon the basis of the Illinois yield. It makes all the difference in the world what prices we allow for our produce.

The other point which I wish to mention was raised by Director Redding, of Georgia, regarding the large quantities of plant food in our soils. Even in our soils in Illinois we have 600 pounds of phosphorus per acre. We are coming to look upon the phosphorus in the soil as being available by some sort of percentage; that is, we do not look upon that 600 pounds as being so much that we can slice off at will. We are limited partly by the amount of decaying organic matter, and also by the seasonal conditions, and we are also limited by the root development. Some plants have more extensive root systems which may touch more of the soil particles than others, and if an estimate of the plant food which we can get may be made by calculating the percentage of the surface of the soil particles touched by the surfaces of the roots there would be some percentage relation there. If we can get 1 per cent of the phosphorus from the soil with the ordinary cereal crop, such as clover; if we can get out 1 per cent of the phosphorus in the soil in a normal season, when we have present 600 pounds, we get, of course, 6 pounds of the phosphorus out in the season. If we can get out 2 per cent of the phosphorus in the soil, we would get 12 pounds out. If we had 2,000 pounds of phosphorus in the soil, on the percentage basis of 1 per cent we would get 20 pounds, and with 2 per cent of the phosphorus made available to the root system we would get out 40 pounds. It means a great deal more to us to put it directly upon some percentage basis. What that percentage basis is, actually, we do not know. We must make it as large as we can, profitably.

W. J. **Spillman**, of the U. S. Department of Agriculture. Unfortunately for myself I did not hear all of Doctor Hopkins's paper, but as the general subject is the maintenance of permanent soil fertility, I want to call attention to the importance, from my point of view, of one class of investigations which have not been carried on as extensively as I should like to see them carried on in our experiment stations. Of course I realize very fully that each of us gets a different point of view from the field of agriculture, and I may have misconceived the importance of a certain line of work. I think we will all agree, however, that where it is possible to do so the use of barnyard manure is perhaps the most legitimate means of maintaining permanent fertility, but it is not always possible to do that. That is particularly true in the South, where I have done most of my work, having been called there more often. In the South they have not been able to develop cattle farming. They have been farming longer than you have in Ohio or Illinois, and they have worn their lands out seriously. They have turned to apparently the only source of fertility they have, namely, commercial fertilizers, and have made very large use of them. Some of the States spend as much as 10 per cent of their crop values for commercial fertilizers. The continued use of these materials without barnyard manure has left very large areas of the South with an extremely bad condition of the soil; all over the Piedmont region it has become necessary to terrace the land. A great deal of the farming there is done on stair steps; they are compelled to terrace, otherwise the soil will wash away. It has been demonstrated by the experience of some farmers that, even on hilly land, with an abundant supply of humus in the soil, this washing may be prevented. Barnyard manure is not available and can not be made available to the average farmer in that section at the present time. The other means of developing humus in the soil is green-manure crops. Now, I should like to see these crops studied more than has been done. It is true that some of the stations have carried on interesting experiments and obtained interesting results, but I find myself unable to answer very many of the questions that come up every day from farmers. One of the things that need to be done is to give more attention to fitting green-manure crops into cropping systems. I find in most of the Southern States rye, vetch, crimson clover, and so on fit beautifully, on paper, into almost any cropping system you can arrange. You can sow any of those crops in cotton just after the first picking, and turn them under the next year for corn, at least theoretically. I am anxious to know more about such crops, their effect on the soil, and on the crops which follow them. It seems there are certain crops which you do not dare to plant after plowing under a heavy green crop. Wheat, for instance, does not do well after plowing under a big crop of cowpeas. It seems to do better if you harvest the cowpeas and plow under only the stubble. The same is true of fall-sown oats. On the other hand, it appears that corn is not very particular about acid in the soil, and potatoes especially appear to do well after turning under a heavy green growth. We want more information about how to grow these crops. Frequently, when we try to grow them they fail. The farmer wants to know how to make them succeed.

I merely take this opportunity of calling the attention of investigators to this problem, in the hope that some of them will take my view of its importance and give more attention to it than has been given in the past.

At 5.30 o'clock p. m. the section adjourned until 2 o'clock p. m. next day, November 15, 1905.

Afternoon Session, Wednesday, November 15, 1905.

The section was called to order at 2 o'clock p. m., by the chairman, H. J. Patterson, of Maryland.

UNIFICATION OF TERMS USED IN CHEMICAL ANALYSIS.

C. G. Hopkins, of Illinois. It may be remembered that at the last annual meeting a committee was appointed on the unification of terms to be used in reporting results of chemical analysis, and I would state that a similar committee was also appointed by the Association of Official Agricultural Chemists. Both of these committees have under consideration the general subject, and the committee for the chemists' association has prepared and had printed by the Bureau of Chemistry a preliminary report upon the unification of terms. The desire of both committees has been to get together and make a combined, or unanimous report, so that there would be complete harmony in this; but there is a feeling in both committees that we need more time, and particularly do we need more assistance from those interested in chemical work and agricultural education before making any final recommendations.

The report submitted[a] contained unanimous recommendations with regard to terms to be used in reporting analyses of feeding stuffs, foods, sugars, and insecticides, but the committee was unable to agree as to terms to be used in soil and fertilizer analysis, the disagreement being with regard to the use proposed by Doctor Hopkins of the "element" system of nomenclature.

The report was accepted.

H. Snyder, of Minnesota, presented the following report of the committee on methods of testing cereals:

Report of Committee on Methods for the Testing of Cereals.

The committee on methods for the testing of cereals has undertaken, during the past year, a brief review of the methods employed in the testing of wheat for commercial purposes. Because of the extent of the subject, work with the other cereals was not undertaken this year.

The methods employed in the grading of wheat by the different States and commercial bodies are based largely upon the physical properties, as weight per bushel, uniformity, plumpness, size, hardness, color, and soundness. There appears to be but little literature available giving the actual flour yields of different types and grades of wheat. The work that has been found upon this point indicates that the yield of flour from both soft and hard wheat varieties is directly proportional to the weight per bushel of the grain.

In the case of soft wheat, Mr. David Anderson, a practical miller of Noblesville, Ind., has prepared a chart from actual experience, giving the yield of soft wheat flour from wheats of different weights per bushel. This chart is based upon the thoroughly cleaned wheat, an especial aspirator being used for this purpose.[b]

Milling chart—Soft wheat.

Weight of wheat after aspirating, clean test.	Flour to bushel.	Food to bushel.
Pounds per bushel.	*Per cent.*	*Per cent.*
64.0	80.00	20.00
63.5	79.25	20.75
63.0	78.49	21.51
62.5	77.74	22.26
62.0	76.98	23.02
61.5	76.23	23.77
61.0	75.47	24.53
60.5	74.72	25.28
60.0	73.96	26.04
59.5	73.21	26.79
59.0	72.45	27.55
58.5	71.70	28.30
58.0	70.94	29.06
57.5	70.19	29.81
57.0	69.43	30.57
56.5	68.68	31.32
56.0	67.92	32.08
55.5	67.17	32.83
55.0	66.41	33.59
54.5	65.66	34.34
54.0	64.90	35.10
53.5	64.15	35.85

[a] See U. S. Dept. of Agr., Bureau of Chemistry Circular, "Preliminary Report on the Unification of Terms for Reporting Chemical Analysis."

[b] N. W. Miller, October 23, 1904.

From the chart it will be observed that when wheat weighing 60 pounds per bushel is milled into flour, 73.96 per cent of all grade of flour is secured and 26.79 per cent of feed or offals. While wheat testing 64 pounds per bushel yields 80 per cent of flour and 20 per cent of offals, wheat testing 55 pounds per bushel yields 66.41 per cent of flour and 33.59 per cent of feed. Mr. Anderson has proposed this chart as a basis for the purchasing of soft wheats, and has constructed tables giving the commercial value of flour and feed when wheat is at different prices per bushel.

In the case of hard wheat, Mr. Foster, chief inspector of the Northwestern Consolidated Milling Company, has proposed the following table based upon the average weight of 100 kernels:[a]

Milling test—hard wheat.

Wheat kernels.	Weight.	Flour.
	Troy grains.	*Per cent.*
100	46	74.1
100	44	73.6
100	42	73.2
100	40	72.6
100	38	71.8
100	36	71.0
100	34	70.3
100	32	69.6
100	30	68.7
100	28	67.6
100	26	66.8
100	24	66.8

From Mr. Foster's table it will be observed that the yield of flour from hard wheat is directly proportional to the average weight of 100 kernels. It is believed that these two tables will give an approximate idea of the flour yields of wheat. Experiments at the Minnesota Experiment Station have also shown that the yield of flour is directly proportional to the weight per bushel of the wheat.[b]

While the weight per bushel of wheat may serve as an index to the flour yield, it does not give the value of the flour for bread-making purposes. Experiments have shown that the lighter weight and lower grades of wheat produce flour of equal, and in many cases superior, bread-making value to heavier weight wheat.[c] It is not possible to accurately estimate the bread-making value of a wheat from its weight per bushel or its commercial grade. The color and hardness of the kernels are the physical properties which are the most valuable in determining the bread-making qualities of wheat, but from the data available it is not possible to formulate even tentative standards based on hardness.

It has been found, however,[d] that in the same sample of wheat grown from a uniform lot of seed kernels of different degrees of hardness are present, and that the darker colored and more horny kernels contain the largest amount of protein. This difference in color and density may serve as a means of selecting glutinous and starchy wheats for seed purposes, provided the comparisons are confined to similar varieties which have been grown under like conditions.

It has also been found that it is not possible to select high-grade wheats on the basis of nitrogen content alone, as shrunken and light-weight grains generally have the maximum nitrogen content; but a high nitrogen content associated with a well-filled kernel is highly desirable, provided the nitrogen is in the part of the grain used for flour-making purposes and not in the germ or offal parts.[e]

No definite relation appears to exist between the total nitrogen content and the bread-making value of wheat. Two wheats may contain the same amount of nitrogen and have entirely different values for bread-making purposes, and a wheat of average nitrogen content may produce better bread than one containing a larger amount. Wheats containing a low percentage of nitrogen are invariably of poor bread-making value, as are also occasionally those of average, even high, nitrogen content. A. D. Hall, of the Rothamsted Experiment Station,[a] recommends the determination of nitrogen as a means of selecting "strong wheats," provided the wheats are grown under similar conditions. "But this correlation is only approximate and true for an average of samples, often failing entirely when applied to individual cases."

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[a] Encyclopedia Americana, Wheat.

[b] Minnesota Sta. Bul. 90.

[c] Minnesota Sta. Bul. 85; Ontario Agr. College Bul. 14.

[d] Minnesota Sta. Bul. 85; Kentucky Sta. Bul. 113.

[e] Ontario Agr. College Bul. 14; Nebraska Sta. Bul. 89.

In determining the relation of gliadin to the bread-making value of flour, experiments have shown that, like the total nitrogen,[b] it is valuable in a general way, but taken alone and as the only means for determining commercial value, it fails, as do all other single tests, in absolutely determining the bread-making value of a flour.

Mr. A. E. Humphries, at the recent International Conference of the Milling Industry, held at Paris, in speaking of the relation of gliadin results to the bread-making value of flour, said: "In a general way they agree relatively with the gluten figures; perhaps of the two sets of figures they more nearly approximated to baking results."

It is quite evident that at the present time there are no laboratory methods based on the analysis of the wheat alone that can be used for determining the bread-making or commercial value of wheat. It appears that this can best be arrived at by actual bread-making tests of the flour made from the wheat.

A number of different kinds of miniature experimental roller mills have been devised for wheat-testing purposes. These mills, when properly manipulated, are valuable for preparing the flour samples for determining the comparative bread-making value of a sample of wheat, but they fail to give the actual flour yield. This, however, can be approximately determined from the weight per bushel of the grain.

The committee begs leave to reserve for future reports recommendations of methods for preparing the flour and making the technical tests.

The report was accepted.

A paper by A. M. Peter, of Lexington, Ky., was read by the secretary of the section, as follows:

SOME RESULTS OF AN OLD METHOD FOR DETERMINING AVAILABLE PLANT FOOD IN SOILS.

Happily the day has passed when a chemist may devise a method of analysis from purely theoretical considerations, often imperfectly understood, and then feel justified in putting forward his method as the true and infallible standard, without having tested its accuracy by the determination of known quantities under working conditions. He who pursues this course in these days may expect just criticism at the hands of his contemporaries. Nevertheless, soil chemistry, and even analytical chemistry generally, is still burdened and clogged with the débris of many such methods.

The conditions affecting the availability of plant foods in soils are so complex that theory alone would be a dangerous guide. The amount of available plant food in a given soil is not in field practice an absolute and fixed quantity, like the percentage of gold in a given sample of ore, for instance, the exact amount of which may be determined with great accuracy. The question of availability is rather a question of relative solubilities, and it will now be generally admitted that any method for the determination of available plant food in soils to be of practical value must be comparative, and gauged by experience in the field. And at the present time a vast amount and great variety of material suitable for such comparative studies is within the reach of our agricultural chemists in the experimental fields of the agricultural colleges and experiment stations. The Association of Official Agricultural Chemists has done well to engage in this work, but when, at its annual convention in 1894, it made the beginning by instructing its reporter on soils and ash to make a study of methods for determining the available plant food in soils after the ideas of Dyer, Dehérain, and others, it was not even then necessary to go abroad for a precedent to justify this measure, for an extensive investigation upon the proposed lines had been undertaken forty years before in this country and carried out on an extensive scale under State auspices—an investigation which clearly proved not only that the diminution of the gross amounts of plant food caused by cropping could be demonstrated by chemical analysis, but that the amount of plant food capable of being extracted by a weak solvent and presumably available to plants was diminished also as the soil became less productive. This investigation had for its fundamental proposition the comparison of rich soils against the same after they had been impoverished by cultivation, with the expressed object to ascertain what constituents had been diminished in quantity and solubility and to furnish a guide for the agriculturist in replenishing the same. Such was the work planned in 1854 by Dr. Robert Peter, chemist, and David Dale Owen, chief geologist, of the Kentucky Geological and Agricultural Survey; and because the results are hidden in a series of State reports long out of print is the writer's excuse for presenting a summary of them here.

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[a] Jour. Bd. Agr. [London], 11 (1905), p. 327.

[b] Jour. Amer. Chem. Soc., 27 (1905), p. 1068.

In those days there were no experimental fields under careful and continuous observation, from which the chemist might draw samples for comparative analysis; but the large areas of virgin land in Kentucky, more especially in the Bluegrass region, offered standards of great fertility, while in the cultivated fields examples were to be found of the depletion of available plant food resulting from continuous cropping under an improvident husbandry. To get material for comparative analysis it was planned to collect samples of soils in sets of three: First, the virgin soil; second, soil of the same type from an adjacent old field ten to fifty years in cultivation; third, the subsoil of the old field. These samples were submitted to analysis by digestion in hydrochloric acid of 1.1 specific gravity to determine the acid-soluble mineral plant food, and also by digestion in water saturated with carbon dioxid under a pressure of two atmospheres. While the first process or "general analysis" gave very interesting and instructive results, showing in a large majority of instances a material diminution of mineral plant food by cultivation, it is with the latter that we are now concerned. And the writer has tabulated about a hundred analyses, taken at random, but using only such as exhibited the complete set of virgin soil, old field soil, and subsoil of old field.

The digestion in carbonated water was performed by putting 30 grams of air-dried soil into a strong 8-ounce bottle, filling quickly with the charged water, thus using approximately eight parts of solvent to one of soil, and corking securely. The bottle was then put in a warm place, where the temperature never exceeded 100° F., and allowed to remain about a month, shaking well each day. The liquid was then filtered out, evaporated to dryness, and the residue weighed, burned, and weighed again to determine "organic and volatile matter." The mineral part was then dissolved in hydrochloric acid, and the solution analyzed in the same way as for the "general analysis." It was soon found that the amount of phosphorus contained in the extract was exceedingly small, even when the soil was very rich in this substance. So the determination was omitted. The extracts often contained very noticeable quantities of manganese, especially in the most fertile soils; but this determination was rarely made. Therefore neither of these determinations is tabulated. The determinations of soda and silica have also been omitted from the tabulation, because they showed no regularity and seemed to have no possible significance. These irregularities are easily explained by the fact that the soda determination is a difference, subject to relatively large errors, and by the difficulty in obtaining the soil solution perfectly clear by filtration. The table gives a comparison of the total extract, organic and volatile matter in the same, precipitate by ammonia, calcium carbonate, magnesia, sulphur trioxid, and potassium oxid in thirty-three sets of three samples each, from twenty-three Kentucky counties, representing five great geological divisions, as compiled from analyses by Dr. Robert Peter, State geologist, in 1854–1859. The full-faced type is used when the quantity is less in the virgin soil than in the cultivated soil or greater in the subsoil than in the top soil.

Extract by digestion in carbonated water—Analyses calculated as parts per million of the air-dried soil.

County, Kentucky.	Total extract, dried at 100° C.			Organic and volatile matter.			Precipitate by ammonia (Al_2O_3, Fe_2O_3, etc.).			Calcium carbonate ($CaCO_3$).			Magnesia (MgO).			Sulphur trioxid (SO_3).			Potassium oxid (K_2O).			Geological position.
	Virgin soil.	Old field.	Subsoil.	Virgin soil.	Old field.	Subsoil.	Virgin soil.	Old field.	Subsoil.	Virgin soil.	Old field.	Subsoil.	Virgin soil.	Old field.	Subsoil.	Virgin soil.	Old field.	Subsoil.	Virgin soil.	Old field.	Subsoil.	
Boone	4,600	3,100	1,936	930	380	277	563	240	63	2,330	1,947	1,120	190	136	**139**	74	45	22	223	82	66	Lower Silurian or Ordovician.
Bourbon	8,078	3,149	2,263	1,133	517	308	672	422	205	3,630	1,830	1,413	194	105	75	39	25	22	164	78	62	Do.
Do	6,760	2,834	2,671	1,975	583	442	1,588	496	222	2,763	1,305	**1,530**	58	88	**136**	65	45	45	154	102	64	Do.
Bracken	9,861	3,333	1,454	2,250	585	470	1,063	147	130	5,420	1,573	447	649	591	133	**61**	73	40	104	71	48	Do.
Campbell	2,874	1,386	864	1,000	433	283	713	187	107	781	403	97	128	32	**69**	**50**	65	49	79	48	41	Do.
Carroll	4,890	4,342	2,019	1,317	1,170	490	980	963	297	1,730	1,563	830	183	156	66	**85**	145	50	228	96	56	Do.
Clark	5,633	3,600	2,400	1,717	533	500	280	114	80	2,887	2,231	1,447	149	92	67	41	32	30	94	87	61	Do.
Do	2,633	1,917	**2,194**	705	467	**833**	**167**	181	114	1,347	781	**814**	**89**	110	67	**33**	45	41	**35**	54	**58**	Do.
Garrard	7,634	4,586	3,186	1,230	883	600	930	913	547	4,413	2,117	1,580	323	140	90	41	22	**25**	386	152	49	Do.
Do	4,932	3,343	1,409	1,000	917	483	853	407	320	2,488	1,620	273	**111**	117	43	56	41	34	94	79	35	Do.
Do	**1,400**	2,383	1,974	533	483	273	81	80	88	**263**	1,330	1,185	73	Lost	93	22	Lost	22	102	Lost	54	Do.
Franklin	2,380	1,525	1,436	580	240	**282**	**143**	163	63	997	607	**614**	130	56	53	**60**	78	**136**	130	79	47	Do.
Do	4,083	3,037	897	**692**	783	392	688	463	55	2,113	1,280	163	208	158	50	28	39	28	96	94	46	Do.
Do	**2,076**	2,896	2,054	**583**	633	367	**145**	230	64	**787**	1,507	1,130	**123**	144	113	**41**	50	33	**66**	77	38	Do,
Grant	3,170	2,590	1,428	730	413	237	**180**	222	130	1,199	1,082	430	**109**	146	**333**	**39**	43	34	137	122	71	Do.
Harrison	4,847	4,077	3,093	1,217	917	550	563	530	230	2,580	2,080	1,831	**72**	100	83	**62**	67	62	185	168	131	Do.
Henry	4,617	2,439	**3,382**	1,383	250	**1,440**	930	487	301	1,677	1,280	**1,313**	128	96	33	**45**	56	45	185	58	32	Do.
Kenton	2,460	1,705	1,630	770	270	**370**	337	160	**223**	880	780	410	**66**	113	44	37	22	17	125	85	**96**	Do.
Mercer	**5,200**	5,310	4,090	1,230	1,150	817	**813**	963	580	**2,247**	2,530	2,047	190	83	**94**	**46**	73	39	166	64	35	Do.
Do	11,095	3,754	**6,157**	1,550	540	666	980	280	230	7,813	2,613	**4,870**	400	66	**76**	61	32	32	77	32	**38**	Do.
Scott	**6,114**	6,578	3,599	1,540	1,470	550	494	253	230	**3,663**	4,497	2,383	101	76	**139**	45	45	28	71	58	35	Do.
Oldham	2,100	1,547	1,237	677	340	**420**	113	63	63	**557**	700	253	133	100	90	253	62	53	91	69	**85**	Upper Silurian.
Jefferson	**2,783**	3,066	1,500	600	467	270	114	81	47	**1,580**	1,730	780	144	105	**111**	28	81	33	103	77	31	Do.
Lewis	**2,650**	2,936	1,695	820	733	290	**100**	413	173	**930**	1,247	730	245	194	**203**	22	48	28	137	33	22	Do.
Clark	**3,777**	5,790	1,893	1,327	1,190	750	**853**	1,453	330	**987**	2,296	1,113	**172**	233	**259**	**37**	56	45	93	26	15	Devonian.
Marion	**3,409**	4,478	1,360	**1,460**	1,800	110	473	473	120	**1,063**	1,830	767	133	111	61	36	36	22	87	53	**59**	Do.
Madison	9,550	3,600	**3,743**	2,693	550	**560**	581	147	**167**	4,287	1,903	**1,974**	838	405	**420**	50	28	**39**	208	33	**35**	Do.
Larue	**1,586**	1,970	1,134	715	683	450	**163**	463	43	**317**	453	173	108	61	**81**	39	33	31	**74**	83	**96**	Subcarboniferous.
Hardin	2,742	1,992	**2,093**	827	800	750	687	647	230	830	163	**713**	**63**	72	61	**17**	33	33	106	83	83	Do.
Do.	2,823	1,917	1,078	741	417	233	231	121	47	1,213	730	447	236	120	**127**	Lost	28	28	89	61	32	Do.
Daviess	4,433	3,720	1,587	1,340	800	340	218	168	68	**1,660**	1,798	498	266	233	106	188	90	**113**	142	83	73	Coal Measures.
Jackson	**2,450**	2,483	1,500	917	700	467	813	463	246	**130**	497	163	**90**	159	80	**28**	34	**45**	**45**	93	**148**	Do.
Do	**3,833**	4,750	2,283	**1,067**	1,883	450	1,163	1,030	480	**580**	1,140	230	**141**	161	133	30	22	22	**66**	135	**173**	Do.
Average of 33 analyses	4,469	3,216	2,159	1,129	730	476	566	407	197	2,004	1,498	1,023	189	142	113	55	50	40	126	79	61	
Highest	11,095	6,578	6,157	2,693	1,883	1,440	1,588	1,453	580	7,813	4,497	4,870	838	591	420	253	145	136	386	168	173	
Lowest	1,400	1,386	864	533	250	110	81	63	43	130	163	97	58	32	33	17	22	17	35	26	15	
Less in virgin than in cultivated soil.	11 or 33 per cent.			4 or 12 per cent.			8 or 24 per cent.			13 or 39 per cent.			11 or 34 per cent.			16 or 52 per cent.			5 or 16 per cent.			
Greater in subsoil than in top soil.	5 or 15 per cent.			8 or 24 per cent.			3 or 9 per cent.			7 or 21 per cent.			13 or 47 per cent.			5 or 16 per cent.			9 or 28 per cent.			

The diminution in amount of soluble materials in the old field soil is very striking, especially in the important plant foods, potassium and calcium. The very apparent differences of solubility between the top soil and subsoil emphasize the well-established fact that the plant food of the subsoil is of relatively low availability.

IMPORTANCE OF THE METHOD OF SAMPLING.

If we bear in mind that the samples of top soil for this investigation were not taken to uniform depth, but were taken to the point where a marked difference was noticeable between top and subsoil, not exceeding 10 inches, meaning an irregular depth of from 4 to 10 inches, and also that the samples were not averages in the true sense of the term, but were obtained by digging in one spot, the regularity of the above results is even more remarkable. Unquestionably, for a comparison of this kind, the samples of top soil should be taken to a uniform depth, not exceeding that ordinarily turned by the plow, and it is also important to obtain an average by mixing portions taken from many places. No assayer would consider his work well done if he took for his sample a shovelful of ore from one place in a carload; neither should the agricultural chemist be content with his shovelful of earth from one spot in seven or eight hundred tons composing the first 6 inches on an acre of land. The writer believes the old directions for collecting soil samples are unfortunate and affected by theoretical considerations that have no determinable relation to the practice of the farmer. If one sample be taken to the depth of 10 inches because the soil shows no difference of color above that depth, and another is taken to 7 inches because of a change of appearance there, while the farmer plows all to 7 inches, we have put ourselves out of relation with his work and have obscured existing relations in the one case by mixing into our sample an uncertain amount of material admittedly poorer in available plant food than that which comes into use, while in the other case we get only that which is actually used. From the chemical standpoint, as well as from the standpoint of the farmer, it is the character of the first few inches of top soil that determines whether the crop will thrive or fail. If the first roots of the young plant do not find within easy reach enough available food to support a healthy, vigorous growth they will never be able to penetrate to the subsoil for the necessary supply of moisture and additional food, and the crop will be stunted or a failure. The writer does not desire to discourage the analysis of subsoils in connection with top soils, but advocates sampling to uniform depths, the first, representing the top soil, being well within the depth of ordinary plowing. In the work of the Kentucky station 6 inches has been selected. The samples are taken preferably by means of a tube made of 1¼-inch steel bicycle tubing provided with a tempered steel cutting edge, so constructed that the core of soil cut out is a little less in diameter than the interior of the tube, and reenforced at the top by a heavy steel ring. With such a tube of proper length samples can be taken to a considerable depth without disturbing the surrounding soil and with very little effort. A core from the first 6 inches weighs about 100 grams, so that ten or fifteen cores will give enough soil for the usual processes of analysis, and the sample so taken will represent a much better average than if taken from only one spot. Difficulties may be encountered with these tubes in a soil filled with small stones, and it may be necessary in such cases to have recourse to the spade or other large tool, but the tube will be found much the best in most situations.

The method with carbonated water, like the method of Dyer with citric acid, is an attempt to imitate natural solvents, but in using water more strongly charged with carbon dioxid than is the natural soil water the principle is recognized that the solvents used in the laboratory must be stronger than the natural ones if we would produce in a short time effects commensurate with those resulting from the long-continued action of natural solvents in the field aided by the continuous removal of certain constituents from the solution by the plant roots. This selective action of the roots of plants is a process very difficult to imitate in the laboratory, although it must be a very important factor in determining the result in the field. But even admitting that carbonated water may be satisfactory, under proper conditions, as a solvent for calcium carbonate and that a determination of the potash dissolved simultaneously may give valuable information, the very nature of the solvent renders it difficult to apply in known and constant strength. And its inefficiency in dissolving phosphates renders it useless as a means of determining the availability of the phosphorous compounds. There appears to be no practical or theoretical reason why a dilute solution of one of the more active acids, such as hydrochloric or nitric, may not serve a better purpose than a supposed natural solvent. Indeed, taking into consideration our present knowledge of the process of nitrification in the soil, we are justified in classing nitric acid as one of the natural solvents. The writer gives the preference to nitric acid, not from theoretical considerations, but because it dissolves less iron from the soil than either hydrochloric, oxalic, or citric acids. In the laboratory of the Kentucky station N/5 nitric acid has been adopted as the solvent for measuring the availability of phosphorous and potassium compounds in soils. The digestions are made at room temperature for five hours, with occasional shaking, using the calculated weight of air-dry soil equivalent to 220 grams moisture-free and 2,200 cubic centimeters of solvent and taking for the potassium and phosphorous determinations, usually, aliquots equivalent to 60 and 100 grams of moisture-free soil, respectively. If a nitrogen determination be made and also a digestion in HCl 1.115 specific gravity, and determinations of potassium and phosphorus in that solution, a very satisfactory statement is possible of the amounts of the immediately available and reserve plant food present. After several years' use we think the method gives results that are in reasonable agreement with conclusions from field experience. The following is presented as an illustration of the practical application of comparative soil analysis.

A field of about 15 acres of apparently good bluegrass soil in Clark County, Ky., was plowed from clover in the spring of 1894 and planted in tobacco. On a rectangular area of about 4 acres in one corner of this field the clover had been almost a total failure. The tobacco began to grow well, but after two or three weeks the tobacco on this same area stopped growing, and at cutting time very few of the plants were worth saving, whereas on adjacent parts of the field—indeed, on nearly all the rest of it—there was an excellent crop. The longest boundary line between the good and bad tobacco was straight and well defined, running at right angles to the rows, and as the tobacco had been set by machine, working continuously, the possibility of differences in time of planting, kind of plants, or manner of setting was here eliminated. Neither was there any appreciable difference in the appearance of the soil on opposite sides. The writer collected for comparison two sets of average samples, each containing ten cores by the sampling tube, taken in parallel lines about 20 feet apart on each side of the apparent line of division between the good and bad tobacco. A set of samples was taken also from a bluegrass pasture on another part of the same farm, which had not been in cultivation for a great many years. These samples were given a very thorough analysis, including determination of acidity, nitrites, nitrates, and humus. Only the most important determinations are here given.

Analyses, calculated on the moisture-free samples, parts in 1,000,000.

	Good tobacco.			Bad tobacco.			Pasture.	
	First 6 in.	Second 6 in.	Second 12 in.	First 6 in.	Second 6 in.	Second 12 in.	First 6 in.	Second 6 in.
K_2O by fifth-normal HNO_3	97	7	9	16	17	11	323	208
P_2O_5 by fifth-normal HNO_3	5,552	6,952	7,652	7,768	8,120	7,984	8,520	7,820
CaO	7,000	8,600	8,500	8,700	7,900	8,000	9,400	9,300
K_2O by HCL 1.115 sp. gr	5,490	--------	--------	6,460	--------	--------	6,380	--------
P_2O_5 by HCL 1.115 sp. gr	13,350	--------	--------	17,550	--------	--------	16,950	--------
Total N	2,280	1,580	1,020	2,380	1,060	1,040	3,080	2,080
N of nitrates and nitrites	3.8	1.5	0.5	30.1	6.0	3.0	5.8	1.7

The low solubility of the potassium compounds in the soil where the crop failed points to the cause of the failure, and warns the farmer against planting tobacco again on any part of this field unless artificial fertilizers be used to supply the want. The same cause is suggested for the failure of the clover. The relatively large proportion of nitrogen in the form of nitrates and nitrites in the bad part of the tobacco field shows that this part was equivalent to a fallow, the tobacco not having made growth enough to consume the nitrates. The effect of this was very apparent on the wheat and bluegrass sown after the tobacco, much the best growth being on the part where the tobacco had failed. If these analyses had been made before the tobacco was planted instead of afterwards, it is probable the crop on 4 acres of this field would have been saved by the use of ten or twelve dollars' worth of potash salts.

Incidentally it is to be noted in connection with these analyses that one of them shows the highest percentage of phosphorus that the writer has ever observed or seen reported in any soil—amounting to 1¾ per cent of phosphorus pentoxid. The very large amount of available phosphorus compounds in these samples renders the differences noted in available phosphorus of no significance.

C. G. Hopkins, of Illinois. I would like to say a word about the amount of phosphorus reported in this paper. I have made a computation from the figures given, and I find from 12,000 to 15,000 pounds of the element phosphorus to the acre, which is about ten times the amount we have in our Illinois soil. It is, of course, quite generally known that many of the soils in the region of Tennessee and Kentucky, and even in the Piedmont section in other States, run very high in phosphorus.

M. A. Scovell, of Kentucky. Our bluegrass lands are very full of lime, and streaks and nodules of phosphate of lime occur in many places in the soil, but even the virgin soils are lacking in potash, and we must supply it by artificial means.

W. J. Spillman, of the Bureau of Plant Industry. It seems to me that in this case it is clear that the limiting factor is potash, and the result given by the methods of analysis agree with the results of the crop. Now, immediately the question arises that where potash is the limiting factor and the result agrees with field tests, we should like to see it tried on a soil where phosphoric acid is the limiting factor.

We must not confuse the available amount with the amount the plant uses. It does not use, and could not very well use, all the phosphoric acid available in this soil.

Soil Investigation.

A paper upon this subject was read by C. E. Thorne, of Ohio, as follows:

The dream of the earlier chemists, that chemical analysis would prove to be the magic key which would unlock all the mysteries of plant growth and soil fertility, has proven to be only a dream; for, while chemistry has made and is still making contributions of priceless value to our knowledge of the soil on the one hand and of plant nutrition on the other, we have come to realize that our study of these problems must be directed along several lines of inquiry, no one of which may be neglected.

It is a well-known fact that soils derived from limestones are, as a rule, much more productive than those originating in noncalcareous rocks; while these rocks again produce soils differing widely in character. The geological origin of a soil is therefore a matter of prime importance in determining its value; but this origin is not always revealed by analysis, either chemical or mechanical, hence no classification of soils can be accepted as satisfactory which does not take this factor into consideration.

It is very true that our information respecting the relationship between geological origin and practical adaptation is, as yet, very imperfect, and the extension of the boundaries of knowledge on this subject is, in my judgment, one of the most important objects toward which soil study should be directed. There is in existing agricultural and scientific literature a very considerable accumulation of data upon this question, which if collated by an expert soil geologist, might be made very useful as the point of departure for further studies along this line.

Within very recent years we have learned that biological factors play a very important rôle in the soil, but as yet we stand only at the threshold of knowledge on this subject. The discoveries made in this direction have thrown a new light upon the function of lime in the soil, suggesting that in some cases this function may be chiefly to furnish a base by which the nitric acid, resulting from the growth of the soil organisms, may be neutralized.

EXPERIMENTS WITH LIME AND FERTILIZERS ON AN ACID SOIL.

At the Ohio station, the soil of which is chiefly derived from sandstones and shales, we have had some very interesting experiences in the culture of clover. For a number of years it has been increasingly difficult to secure a satisfactory crop of the common red clover. We get a good stand in the spring and when the wheat crop is removed we find a sufficient number of clover plants, but over considerable areas their growth is small, and remains so throughout the season. There will be occasional patches of fairly good clover, especially where barnyard manure or certain nitrogenous chemical fertilizers have been used, but even in these cases the growth is far from perfect.

Since 1893 an experiment has been in progress at this station in which corn, oats, and wheat are grown in rotation, followed by two years in clover and timothy, the test being duplicated on five tracts of land, so that each crop is represented every season. Each tract is divided into thirty plats. Every third plat is left continuously unfertilized, while fertilizers of different composition are applied to the cereal crops on the plats between. In 1900 we began dressing these tracts with lime, applying caustic lime as a cross dressing to one-half of each plat. The lime has been applied as a surface dressing to the corn crop, and as we plow the corn stubble for oats and the oat stubble again for wheat, the lime is first turned under and then brought to the surface again before the wheat is sown.

We have now harvested three crops of clover hay in this test, and in the accompanying diagrams I have endeavored to show the general outcome. Diagram I represents the seven-year average annual total weight of produce for the cereal crops as found by taking one-third of the total weight of the three crops, and Diagram II shows the three-year average annual weight of clover hay on both the limed and unlimed halves of the plats. The first five years of the test during which the land was being brought under experiment are omitted because of greater uniformity of the later results.

These diagrams have been constructed by taking the average yield of all the unfertilized plats as the basis and adding to this yield the increase found by comparing the yield of each fertilized plat with those of the two unfertilized plats between which it lies.

The diagrams show that acid phosphate, used alone or in combination with potassium chlorid only, has produced a marked increase in the cereal crops, and a similar increase in clover after liming, but in the absence of lime there has been practically no increase of clover from these fertilizers. It is noteworthy that the small increase of unlimed clover after potassium chlorid disappears when acid phosphate is added to the potassium, as shown by comparing plats 2 and 8.

Taking the second section of each diagram, we see that incomplete fertilizers containing sodium nitrate have produced a uniform increase in both the cereals and clover, both with and without lime, the point of interest being the much larger yield of unlimed clover on these plats than where the nitrate has been omitted.

The third section of each diagram shows the yields from the complete fertilizers containing sodium nitrate, which is added at the rate of 480 pounds per acre for every rotation except on plat 12, where the quantity is increased to 720 pounds. Comparing these plats with No. 6, which receives 480 pounds of sodium nitrate with acid phosphate but no potassium, we see that the addition of potassium has evidently increased the yield of the cereals, and still more evidently that of the unlimed clover. Comparing with plat 8, which has phosphorus and potassium, but no nitrate, we see that whereas the unlimed clover on that plat has made no increase, the limed clover very nearly equals the yield obtained from the complete fertilizer. In other words, the combination of lime, phosphorus, and potassium seems to have brought the clover crop to perfection without the addition of any nitrogen carrier, whereas the cereal crops show very plainly the need of nitrogen. Other points of special interest brought out by this section are (1) that the further increase of sodium nitrate on plat 12 has apparently produced no further increase of the unlimed clover, though a small additional increase is shown on the cereals and the limed clover; (2) that the bone-meal plat, No. 26, while materially below the average in cereal yield, shows a full yield of clover, and (3) that the plat receiving dissolved boneblack, No. 27, while giving a full yield of cereals and of limed clover, falls below in the yield of unlimed clover. While the diagram shows a slightly greater weight of hay on the unlimed end of plat 11 than on that of plat 26, the fact is that in two years out of the three the yield was considerably larger on plat 26, indicating that the apparently smaller yield on this plat in the average is due to a variation in soil conditions.

The last section of each diagram shows for the cereals an almost uniform yield for the different carriers of nitrogen, and a fairly uniform yield of the limed

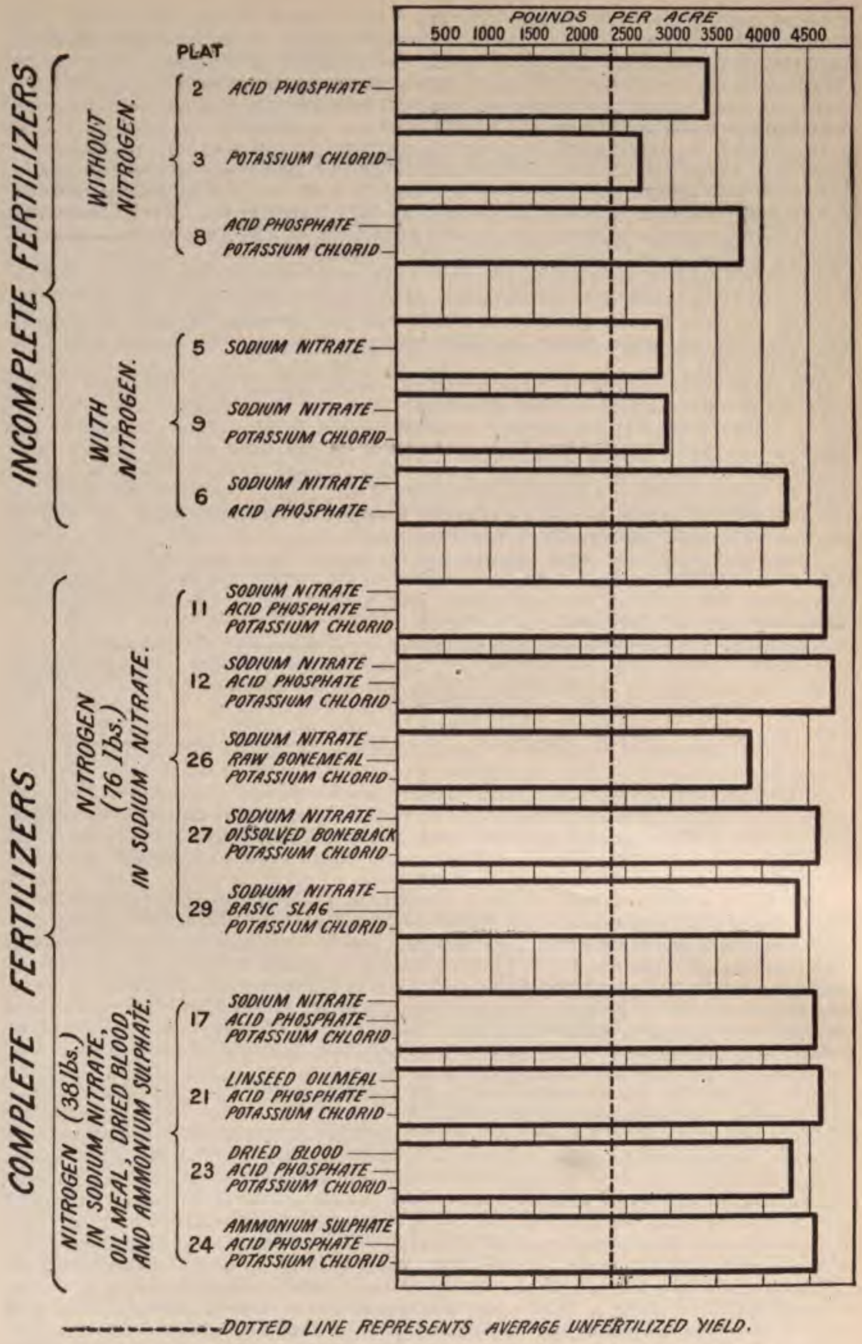

DIAGRAM I.—Seven-year average total produce of corn, oats, and wheat.

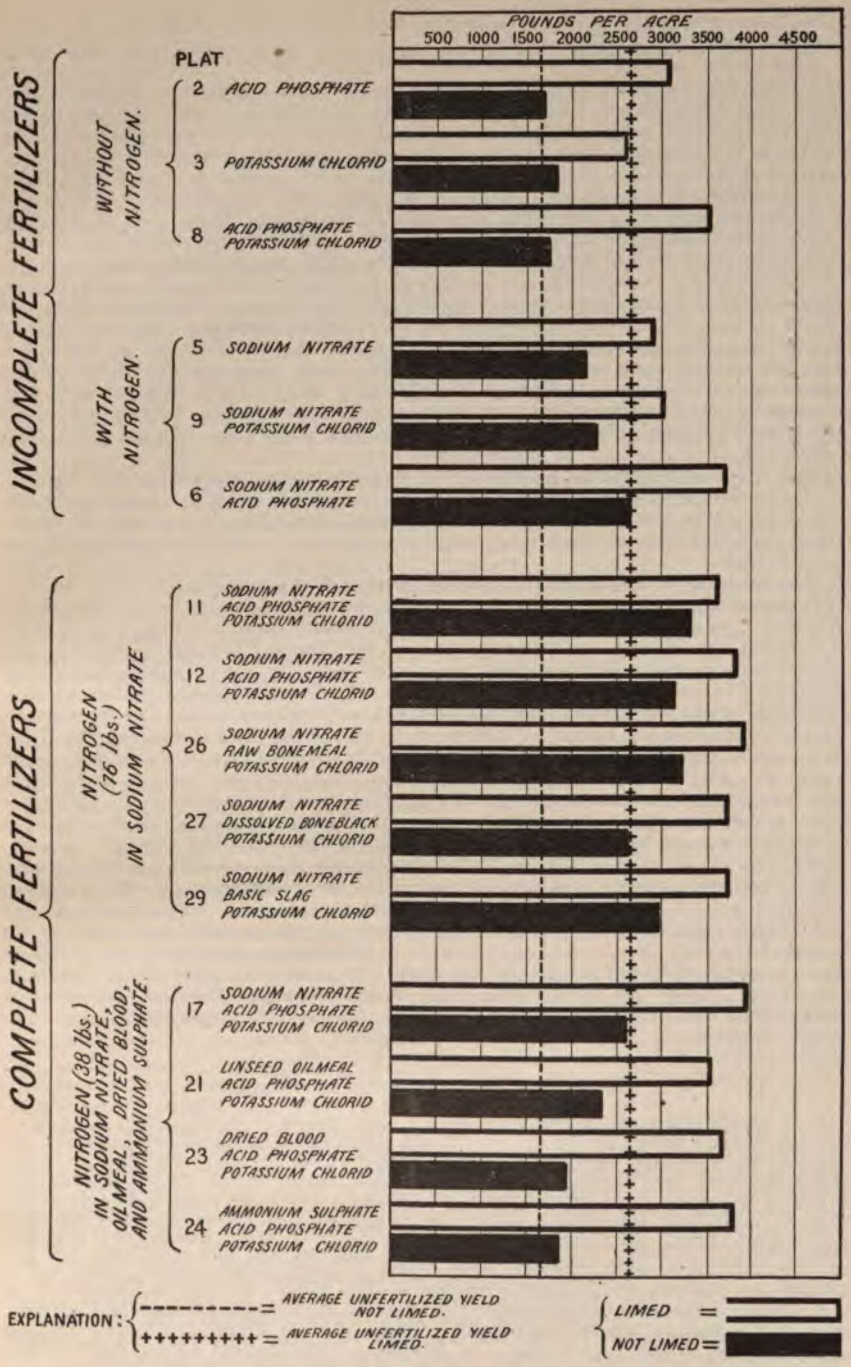

DIAGRAM II.—Three-year average yield of clover hay.

clover; but the unlimed clover shows in every case a lower yield from the other carriers than from sodium nitrate.

Attention is especially called to the fact that the yield of the unlimed clover, following the complete fertilizer containing ammonium sulphate as the carrier of nitrogen (plat 24), is practically identical with that of plat 8, fertilized with potassium chlorid alone; whereas the limed half of this plat produces a yield equaling the average yield from fertilizers in which the nitrogen is carried in sodium nitrate.

Taking the experiment as a whole, it is evident that phosphorus has been the controlling element in producing increase in the cereal crops, and that, after phosphorus, nitrogen ranks next in importance. With clover, however, lime is evidently the substance first in demand. After lime is supplied, then phosphorus and potassium are required, and in the order named. Given plenty of lime, it would seem that nitrogen might be almost entirely dispensed with as far as the clover is concerned, for the results of the test indicate that the increase of clover, following sodium nitrate, is due rather to the sodium than to the nitrogen, the sodium apparently serving to some extent as a base with which the excess of soil acids may combine. This work is still in the tentative stage, but its results show a much greater lime requirement in the soils which have received no sodium nitrate than in those which have been dressed with that substance.

The effect of this liming on the cereal crops has been to increase the yield of corn and oats by about 10 bushels per acre, and of wheat by a smaller quantity. The liming has also apparently slightly increased the effectiveness of the fertilizers, but this increase has been small as compared with that observed on the clover crops.

The outcome of these experiments raises a host of questions:

In the first place, what is the meaning of the increasing acidity of this hard-run soil? Is it due to an organic or a mineral acid? If to the former, why does its increase seem to be in inverse ratio to the amount of organic matter left in the soil by the growth of crops, and why does the use of sulphuric acid in fertilizers increase the difficulty? If the acidity is of inorganic origin, what is the cause of its increase on soils which have not received acidulated fertilizers? Is it the acid itself which is injurious to clover, or is the acidity merely a symptom of some other toxic condition? And why does the common red clover suffer so much more from this toxic condition than the cereal crops, and alfalfa still more than red clover? In what way does lime act to correct this unfavorable condition? Does it simply serve as a fertilizer, satisfying the lime hunger of the plant; and is its superior effect on clover, as compared with th cereals, due to the much greater relative lime requirement of clover than of the cereals? Or is the effect chiefly due to the setting up of conditions more favorable to nitrification and to the functions of the symbiotic bacteria? What is the meaning of the great effect of sodium nitrate on clover on unlimed land, and of its meager effect on clover on limed land? Is the sodium furnishing an alkaline base to neutralize the acidity of the soil? If this were all that is required, would not a large application of sodium nitrate dispense with the necessity for lime, which it seems not to have done, in the case of these experiments, although it has considerably reduced the effect of lime?

THE STUDY OF SOIL ACIDITY AT WOBURN.

The Woburn experiments of the Royal Agricultural Society of England are conducted upon "a light sandy loam, deficient in lime," a description quite applicable to the Wooster soil of the Ohio station. In these experiments wheat and barley have been grown in continuous culture since 1876, with different fertilizing compounds. Plat No. 2 has received a mixture of the sulphate and chlorid of ammonia without any other fertilizing material, and for twenty years this plat produced good crops of barley; but at the close of this period a condition set in much resembling that which has become manifest in the clover in the Ohio experiments, the growth first being spotted and uneven, and finally failing almost completely. This soil was found to show a decided acid reaction to the litmus test. In 1897 lime was applied to one-half of this plat, with the result that the former luxuriant growth of barley was restored, whereas on the unlimed half the growth became continually more feeble. The wheat crop did not begin to fail on the similarly treated plat until several years later, but by 1903 it also was showing signs of distress. In pot-culture tests both barley and wheat were found to be much more susceptible to this trouble than oats.

In the Woburn experiments sodium nitrate produces no such unfavorable effect as that following the use of ammonium salts. In these experiments, however, a mixture of the sulphates of potassium, sodium, and magnesium with superphosphate has apparently produced no injurious results as yet upon the barley crop, the effect of this dressing corresponding to that observed upon the cereal crops on plat 8 in our tests. When to this dressing, however, ammonia salts are added, the yield is reduced to a point below that of the unfertilized land unless lime is added, but with lime the mixed minerals and ammonia salts produce a larger yield than the same mixed minerals with an equivalent quantity of nitrogen carried in sodium nitrate.

Doctor Voelcker has studied, by pot tests, the effect of these fertilizing substances upon the physical condition of the soil, and finds:

"(1) That there is a great difference in the mechanical condition of the soil produced by the different applications, in regard to the caking of the surface and the rapidity with which water passes through it. Thus distilled water (say rain water) goes through most slowly, the moisture being mostly retained; nitrate of soda forms a hard crust on the surface, thereby often retaining the water on the surface; with sulphate and muriate of ammonia a crust is also formed, but the drying of the soil causes large fissures to appear, and through these the liquid flows away more quickly than in the other cases.

"(2) Variable amounts of organic matter are removed, the distilled water removing comparatively little, while ammonia salts give deeply colored solutions when the drainage first runs.

"(3) As regards removal of lime, it has been ascertained that the order in which this, as well as magnesia, is washed out is: *(a)* (the least) water, *(b)* nitrate of soda, *(c)* sulphate of ammonia, and *(d)* (the most) muriate of ammonia. The rate of removal of lime is about twice as rapid with muriate of ammonia as with nitrate of soda. The results with potash, phosphoric acid, etc., are being worked out.

"(4) It has been noticed that the rate of removal of lime varies greatly with the season of the year, being most active in the spring and summer (the time of most active nitrification) and almost ceasing toward the winter, but commencing again the following spring." [a]

He has also attacked the question as to the nature of the acidity of this soil, first by thoroughly washing the soil, and, second, by drying it on a stone floor for several months. Both methods resulted in the removal of the acid character, and, further, the acidity of the liquor from the washed soil disappeared after exposure for a time to the air. Discussing these results Doctor Voelcker says:

"At first sight one would be disposed to think that the acidity might arise from sulphuric acid or hydrochloric acid consequent on the continued use of sulphate and muriate of ammonia on a soil poorly supplied with lime. But this has been shown not to be so, for the washings of the soil * * * are not acid with either of these two acids; however, the fact that the acidity passes off equally on the exposure of the soil to the atmosphere and on exposure of the soluble liquid poured off when the soil is washed shows that it can not be due to mineral acids, but is more probably the result of a feebly soluble organic acid or acid salt." [b]

Doctor Voelcker has carried this inquiry further by growing plants in soil from this plat (1) after it had been exposed to the air as above mentioned, (2) after thoroughly washing it, (3) in soil taken from the headland of the field and treated with liquid used in washing the acid soil, (4) in a check pot of the untreated soil from the acid plat, and (5) in another to which calcium chlorid had been added. The results were that neither wheat nor barley would grow on the untreated soil nor on that treated with calcium chlorid, but both grew well on the washed and exposed soils, and also on the soil treated with the water used in washing. From these results Doctor Voelcker draws the following conclusions, stating, however, that they are only preliminary and require much further investigation before they can be definitely formulated:

"(1) That the acidity of the soil, brought about by the continual use of ammonia salts, or else the condition of soil consequent on its formation, is the cause of the failure of the land to produce barley and wheat.

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[a] Jour. Roy. Agr. Soc. England, 64 (1903), p. 357.

[b] Ibid., p. 358.

"(2) That this acidity can be removed by exposure of the soil either to water and air together (as when it is repeatedly washed with water) or, to some extent, by exposure to air alone (as when it is spread out in the open in the dry condition); after this it will grow quite good crops of barley and wheat.

"(3) That the failure of crop growing does not consist alone in the removal of lime from the soil, inasmuch as if the acid be removed (as above) the soil still has enough lime to support a healthy crop.

"(4) That the oat crop is not injuriously affected by the soil acidity of the extent that wheat and barley are.

"(5) That removal of lime from a soil takes place far more rapidly when ammonia salts are used than when nitrate of soda is applied, and that muriate of ammonia is a more potent agent in removing lime than sulphate of ammonia, the latter, however, being more exhaustive of lime than nitrate of soda.

"(6) That the effects of the acidity thus produced can not be removed by the use of a neutral salt like calcium chlorid, but that this can be done by the employment of lime, after which healthy crops of barley and wheat can be again secured.

"(7) That the acidity would seem to be due not to soluble mineral acids, but, possibly, to weak organic acids or to acid salts."[a]

THEORIES AS TO THE CAUSE OF SOIL ACIDITY.

Samples of the Ohio soil have been examined by the Bureau of Soils, U. S. Department of Agriculture, and Doctor Whitney, Chief of the Bureau, reports as follows:

"The soil grains themselves are very acid to litmus and a faintly alkaline solution of phenolphthalein, but not to methyl orange. The aqueous solution prepared from the soil is only slightly acid as compared with the acidity of the soil grains themselves, showing that the acid of the soil is only very slightly removed from the soil grains by water. This slight acidity is more marked with phenolphthalein than with litmus, but this is wholly due to the greater sensitiveness of the former indicator. Litmus paper contains always a trace of alkali, and is, therefore, not sensitive to such small amounts of acid. When a carefully prepared litmus solution is used as an indicator with a sufficiently large amount of soil extract the acid reaction is readily and definitely noticed. This acidity persists even after boiling for a considerable time, in fact, after concentrating the solution to one-tenth of its original volume, thus showing that the acid reaction is not due to carbonic acid. As, however, the solution, either in its diluted or concentrated form, does not show an acid reaction with methyl orange, it follows that the acid present belongs to a class of weak acids, probably an organic acid, or possibly an acid phosphate.

"On heating the soil to redness for a sufficient length of time to burn out the organic matter and then treating with water containing litmus or phenolphthalein the soil does not show an acid reaction, but evidently an alkiline one, indicating that the acidity in its original condition was due to an organic acid and not to an acid phosphate.

"The following considerations will show that this acid substance in itself is not deleterious to the wheat plant, and that the beneficial effect of lime on this soil is due to some other cause than the neutralization of the acid.

"In the first place, we find that when the soil is made faintly alkaline with sodium carbonate or with sodium hydrate the transpiration and growth of the plant is not increased nearly as much as upon the application of lime. Furthermore, by the addition of 250 parts per million of concentrated sulphuric or hydrochloric acid to these acid soils there is no apparent effect seen in the transpiration or in the green weight of the crop. Even stronger arguments follow.

"The addition of 100 parts per million of nitrate of soda to the Wooster soil increases the transpiration from the plants and the green weight of the plant fully as much, if not more, than 1,000 parts per million of lime; that is to say, the nitrate of soda in the above proportion appears to be quite as efficient as the lime in increasing plant growth. The soil, after treatment with the nitrate of soda, in which the plant growth is fully as satisfactory as when the lime is used, is still acid, even after the plants have grown in the soil in this satisfactory manner for some time. In other words, the nitrate of soda does not correct the acidity of the soil * * * but does increase the plant development without removing or changing the acid condition.

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[a] Jour. Roy. Agr, Soc. England, 64 (1903), p. 361.

"If we take up now the extract of the soil we find that the addition of lime or of nitrate of soda will have the same effect in increasing the transpiration and the growth of plants in this extract as they did when applied to the soil itself. We have obviously, therefore, transferred the cause of the infertility of the soil from the soil itself to the extract. We find that by treating this extract with carbon black the transpiration and the yield of green matter are increased almost, but not quite, as much as from the use of lime or nitrate of soda, but here again, although we know that carbon black has a remarkable power of clarifying solutions and removing certain organic impurities, it does not act on all kinds of organic substances, and, whatever effect it may have had upon this soil extract, it does not sensibly diminish its acidity. Plants grown, therefore, in this carbon-treated extract, showing a satisfactory increase in transpiration and in yield, are growing in as acid a solution as in the untreated soil or soil extract. It is fair to suppose, therefore, that in the case of the wheat plant the infertility of the soil is not directly due to the acid substance, but to some accompanying organic product which is changed or destroyed by lime, nitrate of soda, or by carbon black.

"In our experience here at Washington we find on charring a soil, or on treating it with pyrogallol or with manure, that if examined immediately after the treatment the solution may still show the same acid properties, accompanied nevertheless by increased fertility, or these acid properties may even increase by these treatments to a marked extent even to the present detriment of the soil, as in the case of the charred soil which may become caustic and corrosive, but on allowing the soil so treated to weather for some time the acid properties finally disappear. It may be that in a similar way the soil treated with the nitrate of soda, in which some toxic substance has evidently been changed or removed, will upon standing, and particularly with leaching, lose its acid properties because of the destruction or removal of the agents which produced it, or of the substances from which it was formed."

It will be observed that Doctor Whitney and Doctor Voelcker agree in ascribing the acidity of these soils to some other acid than sulphuric or hydrochloric acids, and this assumption is supported by the fact that Ohio soils, which have received neither of these acids in fertilizers, show a similar reaction to the litmus test. With respect to Doctor Whitney's assumption that the fact that this acidity disappears after heating the soil to redness is proof that it was due to organic acids. Doctor Hopkins, of the Illinois station, calls attention to the fact that the ash of organic matter is almost invariably alkaline, and holds that "it is altogether probable that this alkaline ash resulting from the organic matter of the soil would be sufficient to more than neutralize any inorganic acidity which might exist in the soil."

Doctor Whitney discusses this question in the light of experiments on wheat, but both Doctor Voelcker's test and our own show that wheat is relatively insensible to acidity of soil. In the Ohio experiments wheat is producing a fair and increasing yield on the plats which have received the largest additions of acidulated fertilizers, and on which clover has almost totally refused to grow, the average annual yield of wheat for the last seven years being 18.4 bushels per acre on plat 2, 19.2 bushels on plat 8, and 22.8 bushels on plat 24, against an average unfertilized yield of 8.2 bushels. This means that the addition of phosphorous and lime on plat 2, and these, with potassium on plat 8, have enabled the wheat to secure sufficient nitrogen for the production of a yield more than double that given on the unfertilized land. It is possible, and I think quite probable, that the time is not far off when the soil supply of nitrogen will become exhausted, and the addition of mineral fertilizers alone will be insufficient, except where clover has been brought back to its normal functions by the use of lime, but this is for the future.

This far, therefore, progress toward the solution of the soil-acidity puzzle has been a matter of exclusion and we find ourselves still asking the questions with which we started out.

NITRIFICATION AND SOIL ACIDITY.

The work of the nitrifying bacteria of the soil and the oxidation of organic matter is attended with the production of nitric acid, and of perhaps larger quantities of organic acids. This work is going on at the time when the higher plants are in full growth, and their roots, permeating the soil, are in position to absorb at once the nitric acid thus formed. Under natural conditions the nitrogen supply, aside from the small quantity which may be brought down to the soil by rain, is limited by the action of these organisms, and the quantity of nitrogen consumed by the plant will be measured by the amount of available phosphorus, potassium, calcium, and other mineral elements which the soil may furnish. Given a soil deficient in one or more of these elements, but having a physical condition favorable to husbandry, and subject it to a system of cropping and tillage calculated to stimulate the growth of the soil organisms, and we may expect to find the production of nitric acid exceeding its consumption. If the soil be well supplied with lime or some other salifiable base, the excess of nitric acid may be stored as nitrates, which will be held in the soil until used by the plant or washed out by the rain; but in the absence of such a base, and with a rainfall not sufficient to pass through the soil into the drainage, there may be a sufficient accumulation of nitric acid in the soil, together with the organic acids formed as a secondary result of nitrification, to produce a temporary acid reaction. This accumulation of acid will have a toxic action upon the nitrifying organisms which would finally result in limiting nitrification. Let, now, an alkaline base be supplied. The excess of acid will be neutralized, and nitrification will again commence, but unless we furnish not only the base necessary to neutralize acidity, but also such mineral elements as may be necessary to restore the supply of plant food in the soil to equilibrium for the particular crops grown, there will still be a limit to production below that of the normal capacity of those crops.

Therefore, when we add acid phosphate, potassium chlorid, and sodium nitrate to a lime-hungry soil, we may have furnished all the phosphorus, potassium, and lime which the wheat crop requires, while still leaving the lime supply insufficient to feed the clover; and if we omit the sodium the base may be so far insufficient that the toxic effect of the excess of acid will still be manifested in the clover crop, the wheat having consumed all the lime furnished in the acid phosphate. Certainly, under such conditions, the acids carried in the fertilizers would intensify the toxic effect, unless they were so closely adsorbed by the film water of the soil grains as to be completely inaccessible to the plant roots and to bacterial action. It is easy to conceive that such close association might take place as to produce the results which Doctor Whitney has noted in his litmus-paper tests, but my conception of plant root and bacterial action is that it is more vigorous than mere water solution.

Dr. C. G. Hopkins has suggested that future investigation may reveal whether the large accumulation of acidity, especially in some difficultly pervious subsoils, is in the form of organic acids or acid salts, or in the form of inorganic acid salts, such as might result from the reaction of nitric and organic acids upon neutral silicates forming acid silicates; also, whether this acidity is retained in soils because of its very low solubility, or because of its absorption in the film water surrounding the soil grains.

An interesting point in this matter is that this season, when the wheat was taken off the fourth section of land which has come under the experiment with lime, there was no such difference between the limed and unlimed ends of the plats as we had noticed on the three preceding sections. The spring and early summer had been marked by excessive rainfall, a condition which continued until August. After the rains began to diminish, however, the unlimed clover practically ceased to grow, while that which had been limed continued, so that now the contrast is nearly as striking as it has been at any previous period.

Another effect of the excessive rainfall has been the production of the greatest crop of clover, on the second year's growth, which has been harvested in this region for many years. The liberal water supply has apparently accomplished one or both of two effects. It has removed excessive acidity or it has brought into solution a larger supply of mineral plant food in the soil.

In conclusion:

(1) The Woburn and Ohio experiments have shown that the geological history of a soil is a matter that can not be neglected if we would intelligently prescribe for its treatment.

(2) Both experiments show that chemical problems must occupy a position of first importance in any effective study of the soil.

(3) The Woburn experiments have shown that the physical effect of fertilizers on the soil is a factor to be reckoned with.

(4) Both experiments support the belief that no investigation of the soil can be complete which fails to recognize the vast importance of bacterial action.

Finally, my object in presenting this paper has been to suggest some of the *problems* pertaining to the maintenance of soil fertility which are urgently demanding solution. The particular hypothesis regarding the cause of clover failure which I have offered is a hypothesis only, set up to be established or overthrown by future investigation, and set up in the hope that somewhere the investigator may be found who can unravel the tangle which this particular problem presents, and that somehow the means for accomplishing this great task may be placed at his disposal.

Jacob G. Lipman, of New Jersey. We should differentiate, it seems to me, in the study of soil acidity and its relation to crop production, between the purely physiological influence that soil acidity may have—namely, the influence of the dialysis, or the diffusion of the salts, organic and inorganic, outward and inward, taking the plant roots as the dialyzing membrane—and the bacteriological effect.

Take the case of the success or failure of clover. Why is it that clover does not grow well in acid soils? Is it because there are certain organisms in the soil that interfere with proper germination or that exert a solvent action on the young roots, and thus destroy or undermine the vitality of the young plant; is it because there are certain acid substances produced in the soil which interfere with proper dialysis; or is it because those substances interfere with the bacteriological cooperation that is necessary in order that a clover crop—a successful clover crop—might be produced? Of course we do not know just what the mechanism of nitrogen fixation is in the clover plant. We assume—at least those of us who have given more or less attention to the subject—that the first product in the synthesis of protein bodies is a *soluble* organic nitrogenous substance, and, being soluble, it is liable to diffuse outward through the root or through the tubercle proper, and there is no doubt that this substance, diffused outward, influences materially the character of the bacterial growth outside of the root tubercles. Hiltner, of Germany, has proposed a theory according to which it is not sufficient to have the proper bacteria; that is, *Pseudomonas radicicola* alone is not usually sufficient for the growth of leguminous plants. He claims that within the sphere of root action, in the immediate vicinity of the roots and tubercles, there is a bacterial flora which plays an important part in the normal development of the clover; and he thinks he has proved, with regard to these bacteria, that the first service that they render to the leguminous crops is by consuming the store of nitrates in the soil. He says that, since it is proved that the fixation of nitrogen by leguminous crops is discouraged by the presence of nitrates, it follows that this withdrawing of the nitrates from the leguminous crops encourages the fixation of nitrogen.

Whether that is true or not remains to be demonstrated. But there is another point of view, and that is that the soils which are acid, the flora, the bacterial flora, is entirely different from that in alkaline soils, and we know that in certain changes in the soil the formation of soluble nitrogenous substances may keep pace with the formation of the insoluble nitrogenous substances. We may take, in the laboratory, a culture solution containing soluble nitrogenous substances and convert the latter, by inoculation with certain bacteria, into insoluble modifications without the loss of any nitrogen whatsoever. Similarly, the soil nitrates on the soluble organic compounds may be rendered insoluble as fast as they are formed.

If, in the presence of soil acidity, the flora will prevail which will cause the transformation of the soluble into insoluble nitrogenous compounds, then conditions are thereby created that have a very important bearing on crop production.

And, furthermore, if we assume that there are soluble nitrogenous compounds formed within the root tubercles of leguminous plants that they diffuse outward, and that they are rendered insoluble as they leave the plant, then it follows that the dialysis will be thus accelerated, and the nitrogenous substances will be removed very rapidly and rendered insoluble, affecting thereby the character of the leguminous crop.

Then there is another point. Kühn reports a series of experiments where for twenty years he grew nonleguminous plants on rather light soils, with a generous application of potassium salts and phosphates, and there was no diminution in the crop producing power of that soil.

Hall, recently, reports an instance showing that on one of their experimental fields where no leguminous plants were grown for a number of years there was a considerable increase of nitrogen in the soil—several thousand pounds per acre.

A still more interesting experience of our own, an observation made by Doctor Voorhees and myself, was this: In certain sandy soils, where we applied phosphoric acid and potash but no nitrogen, we have been growing millet, which is a very exhaustive crop, for three successive seasons, and yet observed no diminution in the yield of millet. Taking the sum total of the nitrogen yield in the crops, and of the nitrogen now in the soil, and subtracting that present in the soil at the beginning of the experiment and that subsequently added in the seed and water, we find a very large gain from some source.

We do not know what influence the crop has on the growth of the bacterial flora of the soil. There is no question that different crops affect this flora unequally. We know that from crop to crop the bacterial flora may be changed to an astonishing degree. There are certain classes of nitrogen-fixing bacteria which seem to be found in little nests on particles of limestone in the soil, and we may obtain practically pure cultures of them from those little nodules of limestone. These are but a few scattered facts which may throw some light on the interrelation of soil acidity, liming, crop rotation, and the growing of legumes.

While we have looked at soil fertility from different standpoints, and while I do not pretend to regard the bacteriological standpoint as the only legitimate standpoint, yet I think, as Professor Thorne has also pointed out, that the bacteriological problems surely deserve more attention than they are receiving.

H. J. WHEELER, of Rhode Island. What I say to-day you will please accept as tentative and in the line of suggestion rather than as something formal. An attempt will be made to simply point out some of the peculiar and interesting things that arise occasionally as suggestive in relation to soil investigation. Let me refer first to the two-hundredth normal hydrochloric-acid method. This has been tried on some soils, and it apparently shows a considerable amount of phosphoric acid as probably available to plants. The same method of extraction applied in the same laboratory to some of our own soils yielded no phosphoric acid, yet, strangely enough, upon some of the same plats from which the soil was taken we get very good crops of certain varieties of plants.

Now, while there may perhaps be a likelihood of finding a single method of extraction that will tell us as to the assimilability of the potash in soils, it will seem more surprising if we find any single solvent that will tell us for all soils concerning the condition of the phosphoric acid. To make this more clear, let me state that in our own soil we have about 3½ per cent of humus, and there are very fertile soils in the valley of the Rio Grande that have a comparatively low per cent of humus. In our soil a large proportion of the phosphorus is present in the organic matter. In the soil from some other regions a large proportion of it may be present in apatite, iron phosphate, or aluminum phosphate. Is it not too much to expect that any one solvent can show the requirements of these soils in which the phosphorus is present in so many different combinations? This suggests that what we need is a differentiation of the phosphorus in particular soils, and perhaps we shall find that for a certain class of them a certain solvent may be used advantageously [illegible] er class another solvent, and in a third class we must perhaps apr [illegible] its before we can judge of the requirements. It is my hope that some one may take up and study carefully this question of the differentiation of the phosphoric acid in upland soils. We know that the Germans have done a great amount of work in that direction, particularly in connection with the moor soils in northern Germany, and I believe there is a great opening for investigation in that particular line in connection with our upland soils in the United States. I am ready to be disputed on this point, for perhaps our points of view are not all alike.

There is another line of investigation that I hope somebody will take up. We hear much about humic acid, ulmic acid, crenic acid, and apocrenic acid, and perhaps other acid substances belonging in the same category. It seems to me somebody ought to take up the study of the organic constituents of soils and give the subject an overhauling. To-day we are obliged in some respects to cite Mulder when discussing these matters. To be sure, something has been done since his time, but there is apparently yet a great field for work, and I hope there are some here who will take it up. It will do no harm if more than one station undertakes it. I am not one of those who think it is unnecessary to duplicate work. We all recall the case where two men working at the same time in different parts of the country came to the conclusion that each had found the specific organism which caused potato "scab," yet later it was found that one was right and the other wrong. Duplication of work is not always by any means a waste of labor. For this reason I hope that no one will hesitate to attack these problems because of fear that some one else may be working on them.

Another question that should be studied is the following, viz: What is the influence of the materials that we apply to the soil upon the character of the life within it? Just to give you an idea of what I have in mind I will say that two or three years ago we had just money enough so that we could hire a man to do a little bacteriological work in the summer upon the soil of two plats at our station where sulphate of ammonia had been applied. One had been limed and the other not. Some plants do not grow as well after liming as before, while most varieties of plants grow splendidly where the lime has been applied. Now, it struck me as a splendid plan to inoculate from both the limed and unlimed soil upon both acid and alkaline media; and as a result we found that when the inoculating material was taken from the unlimed soil many more forms appeared on the acid than on the alkaline media. When inoculating from the limed soil the reverse was true. In other words, it appeared that the question of whether the lime was there or not had probably exerted a great effect on the amount and kind of both the bacteria and fungi. And I wondered what influence the greater amounts of these organisms and the particular kinds might have upon the growth of agricultural plants. I had hoped at that time that we might get the money from some source to determine these organisms and to study their action and their influence upon succeeding crops, both upon the limed and unlimed soil. It seems to me that there are many opportunities of this kind upon every experimental farm to study in regard to the influence of specific manures or soil amendments upon the life of the fungi and bacteria of the soil. We have heard much recently concerning soil bacteria and the importance of their study, and it has occurred to me that if they are as important as is sometimes claimed, there ought to be an advantage, aside from symbiotic action in legumes, in inoculating old soils which have been lying neglected for years and to which nothing has been applied in the shape of stable or other manures. One trial of this kind was made last year at our own station, but without result. One lot of neglected soil was inoculated from a good garden soil, and to the other the same amount of sterilized material from the same lot was added. If there is anything practical in the influence of the bacterial life, I fail to see why, by some such inoculation tests, it may not be shown. To the possible objection that it was a case of inoculating with mixed cultures arises the fact that a pure culture introduced into an ordinary soil might not better the conditions. If benefit is found to follow such work, specialists may well be set at work to ascertain to what specific organisms the differences are due. This would seem to be a very suggestive line of work for neglected soils.

There is another much neglected line of soil investigation. We hear much talk about soils and their influence upon the growth of plants. We have not had the means to study this subject in Rhode Island except incidentally, but we have tested the effect of probably about 200 different varieties of plants to see how they would be affected by certain differences. Reference is made to two plats of land where sulphate of ammonia has been used with and without lime, and to two other plats where nitrate of soda has been similarly used. In the case of a few plants liming was injurious in both instances, but for most plants liming was beneficial or absolutely essential to their growth. In view of such diametrically opposite results I do not think we should talk about the condition of soils without considering in the same connection the crops that are to be grown. The two can not be divorced. There are some plants which have twice the range of adaptability of others, and a study of the special range and adaptability of plants to these different soil conditions must not be left out of consideration in connection with soil investigations.

We had a very interesting experience two or three years ago where we had tried nine different phosphates. We planted several varieties of plants across these plats and obtained certain results. The next year a single variety was grown upon all of these plats, and you could go out there and see by the variations in height the marked influence of the previous crop upon the one which had followed. Whether that was entirely caused by removal of plant food, whether it was due in part to the influence on the physical condition, or to some noxious influence of the previous crop, or to other causes, has not been ascertained. There should be in connection with soils a very careful study of the effect of given plants upon the particular plant which is to follow. In other words, I think there should be a study of rotations with this specific object in view. At present I do not know of a single comprehensive and specific experiment of this kind in progress in this country or in Europe. It would seem as if these factors have not been sufficiently taken into account in our studies of soil treatment and soil requirements.

Another question which interests me very much is the influence of the texture of the soil upon the growth of plants. As we all know, there have been a number of experiments conducted under glass, which show that one can not grow lettuce successfully in a compact, heavy soil, and yet carnation pinks will thrive well in it. There is a great difference in plants as concerns the texture of the soil best suited to them, and I believe we must study our soils more, with this point in view. Take for example one of our old exhausted soils in Rhode Island, which has 3½ per cent of humus. It is so fine, so compact, and of such poor texture that with liberal manuring with chemicals one can not secure at the outset a good crop of Indian corn or of potatoes; and yet it will yield a splendid crop of rye. From these things I am led to believe that there is a great field for investigation in finding out the influence of texture upon the growth of crops. This matter, if understood, will influence the arrangement of crops in rotations. If we have a poor texture of soil we must put on first a crop that will grow under those conditions, and toward the end of the rotation we can grow plants which demand a better texture. I may be mistaken about the importance of these matters, but I believe there is a golden opportunity for some one.

There is another matter which has suggested itself to me. We have all been trying for a long time to find a solvent which will tell us in regard to the assimilability of the phosphoric acid in the soil, and as you well know, certain Germans at an earlier date and Professor Hall recently have worked at analyzing plants to see if some hint can not be gained from their composition as to the requirement of the soil where they have been grown. We have done similar work in the past year in Rhode Island by way of several preliminary tests. I wish to emphasize that we do not wish to say that we have anything absolutely definite or positive, but it is at least suggestive. We find that the ordinary flat turnip, when grown upon certain soils, contains twice as much phosphoric acid as when grown upon others, and there was a close relationship between the phosphoric acid in the turnip and the amount of crop produced. All I can say at the present time is that we have no conclusion to offer, but it is suggestive that possibly the ordinary flat turnip may be grown upon a soil, and by its subsequent analysis we can draw conclusions as to whether the soil is well stocked with assimilable phosphoric acid or not. We hope to ascertain what there is in this matter and do not wish to prohibit others from making similar trials.

Another line of investigation of interest has been suggested by our experiments with sodium and potassium salts. We have found like others before us that certain kinds of plants are very grasping in their propensities in so far as concerns taking up potash. In other words, they will take out of the soil more potash than they seem to require. In fact, I think Jordan and Jenter showed in an instance of crops of the same size that ten times as much potash was removed from the soil in one case as in the other. Now, we find that where soda is present certain plants take up large amounts of it. In other words, they satisfy their demand for alkali with soda and take out very much less potash. Sodium seems, therefore, to conserve the potassium supply in the soil. If we are right in this, it seems to me of the utmost importance that an extensive and thorough study should be made to find out in connection with what varieties of plants sodium can conserve the potassium supply. With the potato plant it is probably not possible to any practical extent, and with the cereals and possibly with millet the same may be true, but when we grow at least certain root crops there is no question but what if we apply sodium salts liberally there will be left in the soil much potassium which would otherwise have been taken out. This is another fruitful field for investigation, and I think it is an important one. We propose to do something with it in Rhode Island, but we are not intending to usurp it, and I mention this so that if any of you are interested you will take it up and pursue the question further.

Another thing has been suggested by Professor Loew. If he is right, some soils contain so much lime and so little magnesia and others so little lime in proportion to the magnesia that the best results are unobtainable. It seems to me very important to test the question and see if there are such ill relationships actually existing in our soils as one might infer from his writings, for if so we ought certainly to take the matter more frequently under consideration. Personally, I think that in some instances the difficulty attributed to such ill relationships of lime and magnesia was really due to other causes. Yet I have no doubt there may be very much in it, and what there is ought to be found out.

Finally, I wish to seize this opportunity to enter a protest against the use of the word "humus" without qualification. One reads in text-books, bulletins, and in the agricultural press that soils need humus. Now, I may be mistaken, but I think I have seen soils that had too much humus and which were nevertheless suffering from a lack of organic matter. That may seem paradoxical, but what I mean is that there may be so much humus which has so far advanced in decomposition that it fills up the interstices of the soil sufficiently to interfere with the proper movement of air and water. I hope some day we shall have a committee appointed to determine what terms shall be used.

What seems to be needed frequently is decaying organic matter rather than the "matière nôir" of Grandeau.

C. C. MOORE, of the Bureau of Chemistry. I want to emphasize what Professor Wheeler has said as to the possibility of determining the available plant food in the soil, by growing a crop on it and then seeing what is the composition of that crop. If the phosphoric acid is high in that turnip, it would indicate that the plant food in that soil is greater than in that soil which produces a low turnip. I believe that is the very keynote in the investigation of soils. I believe that if the soil investigators would consider the composition of the crop, as Doctor Wheeler suggests, they would find themselves on the most direct line to truth in this research. I have had experience in the Department of Agriculture in making something like 3,000 crop experiments. I have been able to produce crops wherein the yields were identical—that is, within a gram of each other; yet in one instance there would be as much as six or eight times as much potash in one crop as in the other crop. That was simply because I had fertilized that crop with potash. If I had simply determined the yield, this would have indicated that there was no effect of the potash, and I would have been misled.

Again, I have been able to produce enormous crops of straw, but no grain. Now, if I had said that the potash had been ineffective because no grain was produced, I would have been decidedly misled. I have been able in a large series of investigations which I have made to establish no relation whatever between total plant food in the crop and the total crop, or the crop yield.

I think if Professor Wheeler's suggestion is carried out, and the composition of the plant be used in determining the fertility of the soil, it will lead in a more direct line to the ultimate end.

OFFICERS OF THE SECTION.

H. J. Waters, of Missouri, on behalf of the committee on nominations, consisting of H. J. Waters, C. D. Woods, and W. R. Dodson, recommends as chairman of the section, B. C. Buffum, of Wyoming; for secretary, M. A. Scovell, of Kentucky; for programme committee, H. P. Armsby, of Pennsylvania; C. F. Curtiss, of Iowa; M. A. Scovell, of Kentucky; for members of the executive committee, W. H. Jordan, of Geneva, and C. F. Curtiss, of Iowa. (See also p. 51.)

The report was accepted.

At 4 o'clock p. m. the committee adjourned to meet at 2 o'clock p. m., November 16, 1905.

AFTERNOON SESSION, THURSDAY, NOVEMBER 16, 1905.

The section was called to order at 2 p. m. by the chairman, H. J. Patterson, of Maryland.

HOW MUCH DEMONSTRATION WORK AND WHAT KIND SHOULD THE EXPERIMENT STATION UNDERTAKE.

C. E. THORNE, of Ohio. Mr. Chairman and gentlemen, I come entirely unprepared to take part, and especially to lead, in the discussion of this question. All I can do is to crudely outline some of the thoughts that have been passing through my mind of late, without being crystallized into any definite form; but we are feeling this at our Ohio station. We spent ten years there in learning how to experiment. We have spent twelve years in bringing experimental work into such shape as to give definite results. We are now feeling that the work which is to-day most urgently demanded of the Ohio station is that of demonstration throughout the State of the results which these twelve years' work have brought forth. Just how to do that to the best advantage we are not definitely decided. We have, as part of our resources for investigation, several outlying test farms. These we have regarded in the light of, as I have just expressed it, additional resources of investigation. We look upon them as absolutely indispensable to correct work.

Considering not only the problems relating to the maintenance of soil fertility, but also those relating to varieties and their adaptation, and many other questions of general interest throughout the State, we feel that if our work were confined to the one locality where the main station happens to be established—and most fortunately so, we think—the conclusion drawn from that work alone would sometimes be an altogether misleading basis on which to formulate general advice to the farmers of our State. We therefore look upon the help which we are getting from these outlying test farms as of vital importance, and with that help, with the suggestions we get from it and the limitations which it evidently puts upon the results which we are getting at the main station, we are able to speak with far greater assurance that our advice will be safe than we could without this help. These test farms serve in but a very limited way the purposes of demonstration. We expect to make them serve that purpose to some extent in the future, but it will be to a limited extent only that this will be possible. It is but to a limited extent that our work at the main station can serve this purpose. By this I mean that comparatively few farmers of Ohio can personally inspect the work, either at the main station or at either one of these test farms. We feel that this work must be very greatly extended if it is to serve the purpose of convicting and converting the farmers of Ohio, as a class, to the better methods. We can reach some of them through the printed page. We can reach some of them through the spoken word, and we are endeavoring to enlist the cooperation of the farmers' institutes of the State in this part of our work. But, after all, there are some things which must be seen to be believed, or at least there are some things which can only fully impress themselves upon the minds of many people after they have been seen. We have started at the Ohio station a department of cooperative experiments, a special department organized with the idea of enlisting the cooperation of the thinking farmers in every quarter of the State in some of the simpler phases of the station work. We are endeavoring to prescribe for these farmers a few simple experiments: First, in comparison of varieties; next, in a few cultural methods, perhaps, or in certain methods of treatment of seed or of plants for the control of insects or fungus diseases. The outlook at present is very encouraging. We have on our books to-day at least a thousand names of those who have written to us and who are anxious to take up this work. Many of these are ex-students of the college of agriculture of our State, young farmers who have gone back to the farm and who are earnestly thinking over the problems which pertain to their work. We hope that each one of these will become to a certain extent a demonstrator in his immediate neighborhood. We hope to extend the work until we shall have several such men in every township in the State, and we have somewhere near seventeen hundred townships. We are trying to go slowly in the matter, to select from those who apply for work of this kind those who give some evidence of earnestness and capacity and capability for the work, as we realize that it would be very easy to get a large number of names of persons whose interest would be but transient in this matter and who by neglect or careless methods might bring the work into disrepute instead of advancing it. I think we have been extremely fortunate in securing as the head of this department a young man who is full of enthusiasm in this line of work, a young man who had been chosen by the voluntary organization known as "The Agricultural Student Union of Ohio" as its experimenter.

Between this and the best farm there still lies a line of work which it seems to us it will be wise to endeavor to carry out, and that is a line very similar to that which Doctor Hopkins has inaugurated so successfully in Illinois, in which a farm will not be purchased or leased as we have done in the case of our best farms, but arrangements will simply be made with the owner of a tract of land or of an orchard or of a flock or herd of cattle, sheep, or swine, to carry out, under the direction of the station, either through its department of cooperative experiments or through the agency of some of its other departments, certain specific lines of investigation. Our experience teaches us that if this work is to be successfully done we must first find the man on whom we can rely to thoroughly execute the plans which must be agreed upon between him and the particular department of the station in which the work may fall. We must then as thoroughly as possible divorce that man from any pecuniary interest in the outcome of the experiment. We have tried the other plan and have found it almost invariably a failure. So long as the farmer feels that the value of the crop to him is the main point at issue, so long will the experiment be neglected, and therefore if it be a field on which we wish to start some of the lines of soil investigation which we have under way we shall lease that field outright, as Doctor Hopkins, I understand, is doing, and we shall own the crop produced upon the field. We will pay the man who has it in charge, or such agent as he may designate, for the labor performed; but the field for the time being will belong, under lease, to the experiment station. If it be a herd of cattle or sheep or swine we shall make, as nearly as possiblee, a similar arrangement. In fact, we have just concluded an arrangement of that kind, by which a considerable number of sheep are to be fed under our direction. We become responsible for any extra feed that may be furnished and for any loss of thrift that may result from the use of our methods of feeding. Of course this may open room somewhere for disagreement, but we hope to so adjust our agreement with the owner that such openings may be closed in a mutually satisfactory manner. In this way we hope to extend the work of the station into the various quarters of the State. We hope to so extend it that within a few years we may have our cooperators in every township and almost in every school district of Ohio, who will be looking to the station for suggestions along the line of certain experiments more or less simple and who will be carrying out these experiments under our inspection and direction, and whose work will be to their neighbors a practical object lesson in that work.

We realize one thing especially in this work, that if it is to succeed it must be carried out under personal inspection on the part of the station, and therefore the plan of organization contemplates the visiting of every experimenter, so far as possible, by the chief of this department of cooperative experiments or his assistant, or by the chief or his assistant of whatever department of the station the work may be carried out under, these visits to be made as frequently as may be necessary to keep proper check of the work, to give proper encouragement to the experimenter, and to see that the results are not thrown away by mismanagement at any time.

I should say that we have been doing something along this line for a number of years, so that the plan as I have outlined it is not a mere theoretical experiment with us at this date. We have been doing work, for instance, in large commercial orchards in Ohio for a good many years, and it has borne rich fruit in some cases; and while we have not done successful work in the field, we have done the unsuccessful work there which has shown us that this method is the one which must be adopted if success is to be attained, and we have the example of the work Doctor Hopkins has done to show that success is within reach along this other line. We also have the fact of the success that a similar department of cooperative experiments has secured over in Ontario. The interest that has been excited there because of this work has been to us a very great encouragement.

I think these are the main points of the work we are undertaking, and I shall be extremely glad to have any criticism upon it, or any suggestions as to the improvement of this work which those present may be able to offer.

P. A. Yoder, of Utah. I would like to ask Director Thorne how frequently he finds it necessary to visit the outlying stations?

C. E. Thorne. We have no fixed rule. We leave that entirely to the discretion of the superintendent, and it varies with the character of the experiment. With an experiment in variety testing I should say, speaking roughly, that two or three visits during the season might be sufficient, but more frequent visits would be better. I would like to visit them every month during the season, and I aim to do it. If I can not visit them personally, an assistant does and reports to me.

In the case of a feeding experiment, I should say it ought to be visited at least as often as that. In the case of an orchard experiment, we might want to visit it two or three times at short intervals at a certain period, and then it might go a long time, perhaps, without inspection. The whole matter must be adjusted with regard to the peculiarities of the situation, the character of the experiment, and the work that is progressing there.

C. G. Hopkins, of Illinois. Our outside work in agronomy is, to some extent, in the nature of demonstration work. For this purpose we take a long-time lease. We have bought one or two tracts of land where we wanted to carry on work particularly in soil experiments, on broken land, where the land is subject to surface washing, and where we wanted to let some of it wash so that after fifteen or twenty years it would be, possibly, almost completely ruined. In a few instances of that sort we thought it best to purchase the land. But in the main, if we think we can get the results in ten years, we take a ten-year lease and pay a cash rent for the land and have it as absolutely under our control as though we owned it. In that way we can get a field frequently right out of the heart of a man's farm, that we can get the history of, and we know that it practically represents the type of soil that we perhaps could not get if we had to buy the land.

The management of these fields is entirely in the hands of the experiment station. We may make use of the labor that can be furnished by the owner of the land, and if he will furnish as cheaply as anybody else will we give to him the preference. We also accord him preference in the purchase of the crop. After the crop is grown, and we take what we need for seed and other purposes, if there is some to go to market the owner of the land has the privilege of taking it at the market price. We do that because we feel that we ought to encourage the owners of these lands by these experiments, and the feeling exists still that there are crops that ought not to leave the farm. We encourage that feeling by giving the owner the first privilege of taking the crop.

We have superintendents who devote their entire time to the management of the work—one man who will look after the soil of the experiment plats and another who looks after the crops of the experiment fields—and they have as much assistance as they need, and these men not only superintend, but do a great part of the work. In the main we have assistants enough to go from field to field. A man may spend a week on one field looking after the work there and seeing that it is properly done, and in some cases doing it. These men are all men of college grade who are thoroughly familiar with the work, and whom some would say, at first, perhaps, are too expensive men for that work; but there is another purpose and value in their going about from field to field. Frequently when our superintendent is at a field there may be a dozen farmers there to see the grain thrashed. These fields are located in different parts of the State on soils which represent large areas of land as typical soils, and when the crop is to be harvested or thrashed there may be fifteen or twenty farmers there to see it, and it is essential that we should have there a man who is capable of explaining the purpose of the work, and who may perhaps give an address to the farmers of half an hour. So that we think it is essential to have a man who is thoroughly well trained and who does not consider it at all above his dignity to drive the drill or drive the binder or shock the grain. That is part of his work, and as high as any other part, because it is necessary to carefully guard results. It is just as essential that we weigh our wheat accurately as that we weigh the calcium oxid accurately in analyzing the soil. If it takes a good man to make the one weight accurately, it takes as good a man for the other.

The question is asked in regard to the size of these experiment fields. They range all the way from 2 or 3 acres up to 40 acres. I think 40 acres is about the largest field we have.

As regards number, length of service, and expenses of men employed, I would say our men will be out all the time from April 1 to December 1, beginning with the seeding of oats—or even the seeding of clover, in March—and remaining until the last shock of corn has been weighed.

The traveling expenses I can not give in exact figures, but all of our men are required to use mileage books in our passenger associations, by which we get transportation for 2 cents a mile, whereas the regular one-way ticket would cost 3 cents a mile. I would say that the traveling expenses, at 2 cents a mile, for one of our men would probably amount to $150 a season.

Board is a very large item, because most of our men board right at the field, but we generally try to locate the fields close enough to a railway station, so that livery hire is not necessary, although occasionally we have not been able to do that. We have a fairly good telephone service in the State, and, of course, we have the telegraph, which is always open. With the telephone reaching to the farm, we can frequently, by telephoning or telegraphing ahead, have a man from the farm to meet us, so that the livery hire is light.

Aside from the cost of superintendence, and aside from the cost of the fertilizing materials we apply, which is not very great, some of our fields, even on poor land, are paying the State in the products sold more than the cost of the labor upon them. That we do now, or hope to do, notwithstanding that we do all this work on plats from one-tenth to one-fifth of an acre in size, and everything that is done is done to exact measure. Of course that is, as you are all aware, a very expensive method of farming; but on a number of our fields we are getting sufficient, or more than sufficient on some of our products, to pay for the labor—though not for the superintendence—required.

L. C. Corbett, of the Bureau of Plant Industry. I am especially interested in this subject of demonstration work, and I confess I am disappointed in what I have heard, because I consider every remark which has been made as applying simply to experimental work rather than administration work. All these tests, and everything that I have heard spoken of, divest the owner of the land of any pecuniary interest in the results. The demonstration work which the *Department* is endeavoring to carry on is based upon the idea of placing in the hands of the owner of the farm information which will enable him to increase the output of his farm. In other words, it is educational work; it is not experiment station work at all; it is not experimental work. Our conception is to take the results of experiments which apply to any given region and put them in the hands of the farmers, so that they can improve and increase the yield of their fields. That is the kind of discussion that I hoped was coming out of this meeting, and from the general subject one would expect that rather than the experimental phase. Demonstration work and experiment station work, or experimental work, I consider to be absolutely different. Experimental work in many instances, and, in fact, in nearly all instances, is not remunerative; while demonstration work ought to be exceedingly remunerative, because demonstration work ought to take the results of successful experiments which have been conducted on any given soil area, or under given conditions, and put them in the hands of the farmers, so that they can increase their crop production. That is our idea of what demonstration work is, and that is the sort of work we are trying to take to the farmers in the cotton belt, where the cotton boll weevil has been doing its greatest harm. The work I am especially interested in is to go into the areas of the cotton belt, where the people know absolutely nothing, in many instances of horticultural work, and enable them to conduct gardens or small truck areas at a profit. Of course we try to study the soil and market conditions, and all those things which will bear on the ultimate outcome of the work, but we divest it as far as possible of the experiment feature. Now, I realize that that is extension work, or educational work; but to my mind that is true demonstration work, while the other work is experiment-station work, or work of investigation.

C. D. SMITH, of Michigan. In Michigan we have adopted rather the view of the last speaker than that of Director Thorne. To give a concrete instance of the work we are trying to do in our feeble way in the land of the two peninsulas, it was quite impossible for us to get the peach growers to really believe that the results of the experiments of the Department of Agriculture were actually true. We had to go around and give them absolute demonstrations. We took a section of an orchard in the midst of a community that was well educated and well grounded in theory, and by actual demonstration taught them that spraying would prevent curled leaf. They had read your bulletins from Washington, and had an inherent belief in the truth of those bulletins, but did not try it themselves until somebody went down there and tried it for them.

We took an apple orchard in the eastern part of the State. We had been preaching that Michigan was a great apple State, and that the apple orchards ought still to be in good condition; but they said: "That is all theory." We took the orchard of one man and proposed that we should take the profits and pay him, but at the end of the first season he was anxious to back out of the bargain, and we released him on the condition that he would continue the work. That demonstration did a great deal for the apple section of southeastern Michigan. That is not experimental work. We made no effort to make it experimental. In fact, I have never yet found it safe to trust an experiment to a man outside of the station if we intended to publish the result. I never will publish a result of an experiment that is not conducted solely by men in the employ of the station.

We are very much interested in supplies of phosphorus. Farmers have read in the Illinois bulletins what phosphorus will do in that State when derived from the finely ground rock; but you know we have a set of people coming from Ohio and other less civilized portions of the country who made our farmers believe that it was never safe to use phosphorus unless the rock had been treated with sulphuric acid, and we tried the experiment. We asked a farmer if he would not let us fairly test the matter in his section of the State. He furnished part of the fertilizer, and we furnished the rest. We did all the work. This farmer is now demonstrating to the farmers of Jackson County, Mich., the practicability of using the finely ground phosphate rock.

In the matter of animal industry we have certain difficulties environing the whole proposition which have made us reluctant to undertake any demonstration work whatever. In some parts of the State God has tested the powers of man severely by giving him a soil to work on which possesses nothing but sand and wind. In that particular part of the State live stock does not flourish. At the college we undertook some experiments to find out why the live stock does not flourish and we came to certain conclusions. The station went up in that country where a silo was unknown and built a silo, and I am here to say that the results of the demonstration were extremely satisfactory, financially, to at least three counties in the State of Michigan. On the station farm we do not consider it beneath our dignity to carry on considerable demonstration work. For instance, in the matter of legumes, in the matter of seed selection, we like to demonstrate on the station farm, because it is close at hand, what our station has done and what other stations are doing and have done in this matter; but we keep this work entirely divorced from the experiment-station work.

W. H. **Jordan**, of New York. I believe I fathered this subject which is before you by proposing it at the last meeting, and your discussion has taken somewhat the turn I expected it would. I have heard a definition here from Professor Corbett of what is demonstration work. Now, I expect we will have to give an arbitrary definition to that. Possibly I can illustrate what I mean. Some years ago the problem of red spot in cheese came up to us in the State of New York, and we had first to determine what red spot is. That was laboratory investigation. After determining the nature of the trouble, then we had before us the additional problem of how to get rid of the trouble, or control the trouble in the factories. We continued our work until we believed we had a method, and then went into the factories. To do what? To demonstrate the applicability of the method to commercial conditions. Now, according to Professor Corbett, that would be experimental work, because that was the last step in our solution of the problem. His definition, however, of demonstration would be this, I suppose, that after having taken the last step in a few factories, and showing the applicability of the method, if we were then to distribute ourselves to the various portions of the State and repeat that which we knew would happen, in a merely educational way, that that alone is demonstration work. Now, I did not have that restricted definition in mind when I proposed the problem. Demonstration work seems to me, as I suggested the problem, that last step of demonstrating in some form the final relation of a theory or a process to practice. Possibly that had better be included in experimental work, and let demonstration work cover merely that which is extension work or educational work. That is for us to determine. But the larger question which comes up to me is not how we shall define demonstration work, but where the limits of experiment station work shall be. That is the larger problem with us in New York. And the way in which we settle that question will be determined, I suspect, to some extent by the place that the matter of expediency has in our minds. Now, academically speaking, I hold that the proper function of the experiment station ceases when we have shown in a sufficiently extensive and practical manner, so as to leave no question, that our theory or our method is applicable to practice in a profitable way—or an unprofitable way, as the matter may be determined—and when we go beyond that we have stepped into the educational field, the field of merely teaching that which is known. Of course the experiment station men have been unable, by force of circumstances, to keep out of that field, I suspect; for I suppose that you all have the same experience that I have, that every known problem and question under the sun comes up to the station in the form of correspondence. I had a young man write me the other day not long ago saying, "I have purchased a farm"—and whether he had married a wife he did not say; I hope he had if he was a good man—"and I wish you would tell me the most profitable method of managing that farm; in other words, the crops I can raise, and the method of managing it that would give me the most money." A physician, who wished to expend some of his money made in practicing as a physician in playing with a farm, wrote saying that he had a farm in a certain portion of the State, equipped in a certain way, with so much stock and so many trees and so many hogs, and this, that, and the other, and that the farm was laid out in this, that, and the other way. "Now," he said, "I propose to make a certain amount of cider, and do a certain amount in dairying, and in certain other lines;" and he made a table in which he tabulated the lines of work which he would carry on; and on one side he wished me to put down what it would cost him to do that work, and on the other side what he would get out of it.

Now, with that sort of thing coming up to us and an expectant and anxious public, we may be pardoned, I suspect, if we overstep sometimes the proper lines of experiment-station work; but I believe we ought, because of the great problems that are pressing up against us, because of the limitations we all feel when we go before the public, because we know that our ignorance is a natural handicap to us in attempting to provide for the farmers—I believe we ought, to the very last degree of safety—to withhold the work of the station to investigating facts and showing that applicability, and leaving the extension work—what our friend Corbett would call the demonstration work—to the extension work of the university and the college. That is my policy, and I am going to hold to it as strongly as possible and leave to Cornell, possibly at the expense of the popularity of the Geneva institution, the extension work.

C. D. SMITH. I want to call attention to one danger in this extension work, too, and that is this: We did a good thing for a township down near Detroit. But go to, now! Every other township in that section of the State insisted that the next year we should come over in their section and do likewise. And up in "The Thumb" of Michigan the station is now unpopular, because we do not come up there and buy a farm and make demonstration experiments. For that reason I agree with Director Jordan in regard to the colleges and insist that no money of the funds appropriated for the work of the station shall be used in the demonstration work. But the trouble with us, connected with the colleges, is that although we draw but one salary, we are expected to perform various functions, and our division ceases to be as clear as it ought to be, perhaps, because of the fact that we have to do two classes of work, being supplied with two different funds. But there is this danger, of unpopularity growing out of this work as well as popularity.

C. E. THORNE. I wish to make it plain that we regard our three or four test farms as adjuncts to our resources for scientific investigation and not as demonstration farms, but that this work which is being extended over the State through our department of cooperative experiments is in no sense scientific investigation, but that it is carrying to the townships a demonstration of the results of work which has been worked out at the main station or at these test farms. I would not know how to organize a demonstration of the effect of the use of fertilizers of two different compositions on a soil—or of one composition—if I did not lay off alongside of the tract which was to be treated with this fertilizer another tract to receive the treatment usual in that vicinity. I do not call that a scientific experiment or a method of scientific research; I do call it a demonstration. That is where we may differ as to definitions. We have done the same work in the orchard. As a pertinent example, our horticulturists at the beginning of the nineties went down into southern Ohio and persuaded a large apple grower to spray a part of his orchard with the then new Bordeaux mixture. He was unwilling to risk his whole orchard, and he sprayed about a third of it, and the contrast between the two portions was such that it figured out to him $500 that first season, and he has been an enthusiastic sprayer from that day to this, reporting his annual profit from spraying at $1,500 to $2,000 a year. He only became convinced through seeing alongside of his unsprayed trees the trees that had been sprayed under our direction. That was in no sense a scientific investigation. We certainly induced him to make what he might have called an experiment, but which was to us simply a demonstration of what we expected to be the outcome, and which was the outcome of his work.

Now, we expect to make each of the thousands of farms which we hope will take up this work which is being carried on by our department of cooperative experiments—a department which is supported entirely from State appropriations for that specific purpose and not at all from the Hatch fund—a point of demonstration, and a point, we hope, of education to the people around it; and to a certain extent we hope that these people will become experimenters. We hope that because no man can make progress in agriculture in our day unless he is more or less of an experimenter—I want to use another term: unless he has more or less of the spirit of scientific research—and we hope he will take up that work and carry it forward. But the work which he may do is a work of demonstration to himself and his neighbors of principles which we have previously worked out at the experiment station in connection with these adjunct farms.

C. G. Hopkins. We hardly feel that we can separate experiment from demonstration. I might say that if we go out on a certain area, and take 40 acres of corn, or a 40-acre tract of land, no matter if we have in mind simply experiment and discovery—which we never do have in mind—that becomes a demonstration to all the people in that section. We do not separate it and do not want to separate it. We feel that it is more economical to do the two things at once, and we do some things 100 or 200 miles away from the university that we possibly could do at the university in order not only to discover truth, but to demonstrate it to the people of that section.

Furthermore, while I can not quote exactly the language of the Hatch Act, I believe our State law is copied in part from it, and I know our State act says "for discovery and dissemination;" and we take any means of dissemination. If the best means of disseminating a truth is to go right in the field and demonstrate it and teach it to the people of that section, we use our State funds for that just as freely as we do for experiments in the laboratory; and I believe we use the United States funds just as freely. I will not state this positively, but I believe the Hatch Act says "dissemination" as well as "discovery."

W. H. Jordan. I just want to say another word. I get troubled sometimes over what I might speak of as the responsibilities of the institution I am in charge of. And I have had quite a good many arguments with my friends and colaborers in my State over what its responsibilities are for education or in the way of dissemination. It seems to me entirely clear that the function of the station is, first, to find out things, and then to see that they are properly placed before the public. But what constitutes properly placing them before the public? There is where the difficulty comes. I sometimes have troubles with the members of my board of control, like the rest of you. I had with one of them the other day, not a trouble, but a discussion. I used this illustration of red spot in cheese with him. I said: "It seems to me that when we have gone into factories to see we are right, and have demonstrated the applicability of the method we proposed, and then have placed that in simple terms, as we try to in our popular bulletins or leaflets, before every cheesemaker in the State of New York, we have done our duty." But his answer was: "The cheesemaker will not read your bulletin, and unless you go right under his nose, where he may see it, it will not become effective in his case."

Now, where is my responsibility? Am I responsible for the inertia, for the lack of alertness, for the stupidity of that man? What is my duty—to go all over the State, in every corner, and to place under the nose of every man a demonstration, or have I done my duty by him when I have made it possible for him, with ordinary alertness, with ordinary intelligence, and a business mind and impulses, to get hold of the whole thing? Why, gentlemen, if we accept the proposition that we are responsible for these inert fellows, where will our demonstrations end, and where is the fund? I know that Illinois has the biggest one in the United States. I do not mean that she shall have for a great while. Now, that is the proposition—where is the limit of responsibility? I am not taking sides on this, but I am placing before you what you all understand and appreciate as clearly as I do, I have no doubt, in regard to the situation. What shall our answer be? The best we can do, we can not get to a whole lot of men. We may place demonstration work in every county of the State where we are, and in several places in each county, and there will be a very large percentage of the farmers who will not see that demonstration work any more than they will read the bulletins.

H. J. WHEELER, of Rhode Island. If I understand it, there is no authority at all in the Hatch Act for disseminating anything in the line of agricultural information which has not been ascertained by investigation. I am very sure we have all been warned that not a cent of that money can legitimately, according to the strict interpretation of the Hatch Act, be used for anything in the line of demonstration work or in tabulating the results of material already known, but for publishing and disseminating what the individual stations may ascertain by experiments.

In our State we have had this under consideration. After something seems to have been settled on the station farm under our own conditions, the next thing is to ascertain by experiments whether the rest of the State is in the same condition or not, or whether this is generally applicable or not, and we do that by going into each county and selecting a number of representative fields and trying the matter there. When we have ascertained by experiment that the condition in each county is essentially that which we have found at our station the matter is then turned over to the extension department of the college, and it was my pleasure to propose the first raid on the State treasury to get money enough for such a demonstration department in the winter of 1892–93, and we now have such a demonstration department. After we have found out to our satisfaction that a certain thing is helpful, then the demonstration department of the college takes it up and prosecutes it in an educational way, and that is demonstration.

T. F. HUNT, of New York. I want to insist that the questions which farmers ask regarding how to manage their farms are perfectly proper. When a man writes to a station for some information on the principles of fertilizers his questions are answered willingly, because you have a bulletin on the principles of fertilizers which you can send to him. The only reason you may not answer questions regarding farm management is either you have not the information or because it is too much trouble to work out the problems. A question in economics is asked, and economics is just as important, and it ought to have just as much of the attention of the agricultural colleges, as chemistry, botany, physics, or any other science. The only trouble is that we know so little about it and give so little attention to it.

W. H. **Jordan.** I used those examples merely to illustrate the difficult things that come to us, not to make fun of the farmer. I believe it to be true, nevertheless, that such a question, for instance, as the first one I referred to, is an absolutely unanswerable question, because it is beyond the power and wisdom of any station director or any station employee to pick out business methods and the business course for anybody.

I commend what Professor Hunt said of the importance of the study of economics, and that we have very serious limitations in answering such questions, which we ought not to have very long.

H. J. **Wheeler.** When such general questions come in it seems to me that they should, so far as possible, be turned over to the demonstration department of the college to answer. I do not believe in turning the farmer down. It is the business of the college, and it should be the business of every college connected with these stations to have a demonstration department. Now, it is an unfortunate fact, perhaps, that the demonstration departments in all these colleges are not yet capable of answering all the questions that come in; and perhaps the stations are still answering some of them. The point I want to make is that just as fast as it is possible, and the right men are provided in the demonstration departments to answer these questions, all such questions should be diverted to that department, so as to leave the research end to its legitimate work.

C. G. **Hopkins.** I would like to raise the question whether the man who has discovered the facts and has them all in his hand had not better be a member of that other department, because he is best able to answer?

W. J. **Spillman**, of the U. S. Department of Agriculture. This is a subject which is very vital and intensely interesting to me. In the first place, I want to object to the use of the term "demonstration farm" for the demonstration station. A farm and an experiment station or a demonstration station and a demonstration farm are wholly different things. A farm is a business proposition. A station is a place for demonstrating or for experimenting, as I understand it.

I like Doctor Wheeler's suggestion that demonstration work be taken up seriously by the college, and that it belongs in the college rather than in the station; and yet the station men belong there a part of their time. There are many things they know better than anyone else. Without encroaching too much on their time, we ought to utilize their knowledge.

The necessity for demonstration work may be illustrated as follows: Here are certain things which Director Thorne shows to be true with respect to fertilizers on a certain type of soils and with certain crops. Farmers in distant parts of the State do not get a chance to see these results. Many of them do not even read the bulletins giving the results. Generally speaking, the farmer is not in the habit of getting his information by reading. Now it is legitimate, if we have the funds and the men, to establish a station where we can carry on a demonstration of that which has been shown to be true. But we must not confuse demonstrations of this character with demonstration farms, such as those we are conducting in conjunction with some of the southern stations. Now, a farm is a business proposition. Our demonstration farms are farms which are being run for the purpose of making so much money that they will attract public attention. They are not stations; they are not plats; they are farms. On one of these farms we are making a net profit of $75 an acre. The man who owns the farm is doing that. Professor Duggar will tell you that that farm has made an impression on the community in which it is located; and it is changing farm practice there in a remarkable manner. So I want to enforce that difference between a demonstration farm and a demonstration station or demonstration plat.

I wish that I had time to give you the reason we have developed certain types of farming in the South. That will get to you through the regular channels, sometime. On the particular farm referred to hogs are raised on alfalfa, but the rule is to feed the hogs 1 to 2 per cent of his live weight in corn per day. When the alfalfa is at its best the hog receives 1 per cent of his weight in corn a day; but if the alfalfa pasture runs low, it is 2 per cent. The hogs are ready for the southern market almost any time, but for the Chicago market they would need a little fattennig period later. They are producing the hogs at not over 2 cents per pound, and they sell them at 5 cents. With corn at 80 cents a bushel, they made $75 an acre for the alfalfa. That is a demonstration farm for which Professor Duggar and M. A. Crosby of my office and myself are responsible.

I believe that it was Director Jordan who spoke about the advisability of a man assuming the responsibility of advising regarding the business management of a farm. I just want to offer this suggestion in that connection, and one or two of my colleagues in the Department have made the same suggestion. I should hesitate to prescribe medicine for a sick man, but I know people who would not; people who have paid particular attention to that thing, and make it their business. Most experiment station men have not made a special study of the business side of farming, and perhaps they should not; because we need some men who are going to dig deep into nature and learn new facts, and a man who is busy and loading himself up with the responsibilities of the business management of farms is going to find his investigational work seriously interfered with; but it is possible for a man to devote himself to the business management of farms, and you will find that there are principles involved there, just as there are in the application of fertilizers. There are principles involved in the business management of the farm which a few years' study will develop, so that a man will, if he devotes his time to it, be able to outline a cropping system for the farmer. To do that a man must study; a man must first become familiar with the types of farming that have proven particularly successful in a given section of the country. That can be done and is being done. When we have learned that, we find that the principles are comparatively simple. We find, too, that the farmer, the man who is making a preeminent success, who is getting rich off of a small farm, is almost invariably a book farmer. I have not found a single exception to that yet. But the converse of that is not true. I have found some book farmers who are not getting rich on their farms. By book farmers I mean they are men who understand a good deal of the science of agriculture, and are making use of that science in their work.

Now, the office of farm management burdens itself with the business side of farming. We have found in our study of farms and farmers that one of the most important phases of the business management of the farm is the understanding and application of scientific principles in the production of crops, in the handling of soil, and in the feeding and management of live stock. We are making an attempt to compel the farmer to adopt scientific principles. The results you men are securing in your investigations in the experiment stations we are trying to force the farmer to adopt in his work. Now, we find through the country, in some sections much more than others, that there are farmers who have adopted the results of your studies, and have worked out that important problem, fully as difficult in many cases as your work in discovering it was, of how to take advantage of that knowledge and to make money from it on the farm. Take Mr. Detrick, for instance, about whom so much has been written. There was a man who had worked out the important problem of how to utilize scientific knowledge on the farm; and I confess that I learned more from that man in one day about the application of scientific principles in farming, and the business features of farming, than I had learned in two years previously. His was a phenomenal case; but his was not the only one.

Although a few years ago I felt that it was hardly fair to say that there was such a thing as agricultural science, I am now prepared to say that there is such a thing as agricultural science, and to defend that opinion. Now, this body of knowledge has been gathered from two sources. One is the work that has been done by experiment station men. A large body of knowledge has been obtained by careful scientific inquiry, and a good deal of it is classified, arranged, and usable. On the other hand, we sometimes overlook the fact that every farm is an experiment station, though an experiment station is not and should not be a farm. But the farm must be an experiment station. And every farmer in America is an experiment station man and is investigating. It is true that he is hewing wood with a dull ax frequently, and he is sawing with a broken-toothed saw; but he gets his log sawed in two sometimes.

Now, no small part of this thing we call agricultural science comes from the gathering up and sifting of the experience of the farmer. And now I want to say this. Some of you experiment station men may differ with me here. But you let me study carefully the work of one hundred farmers, and let me draw my own conclusions from their experience. I would like to have their conclusions, too, although I usually do not care very much for them. Still, I like to get them, because they are frequently exceedingly suggestive and quite frequently correct.

You let me draw my conclusions from the experience of 100 men—if I can get the facts of their experience—and I will come pretty near getting the theory from their experiences, whether they had any idea of carrying on experiments or not.

I have found a number of farmers who, in the handling of barnyard manure, used enough absorbent to hold all the liquid along with the solid, and who have developed a system by which they carry the manure to the field and spread the manure as soon as it is made—every day or every two days. Now, the farmer has not carried on any scientific investigation to find out whether by that practice he loses a lot of plant food, and he does not know; but, gentlemen, the farmers who are doing that are producing the largest crops of any men in the United States.

Now, I contend that the fact that the men who were doing that, and without the use of any commercial fertilizers, are sometimes producing crops three times as large as we expect a good farmer to produce, proves that that practice is perhaps the best practice, where it is feasible; and I have drawn that conclusion from the practice of those farmers. I may be wrong in that, but I have done it; and I claim that we have gotten a large part of this thing we call agricultural science from a study of farm practice. By the way, we adopted at one time, and decided to call the office which I represent by the name of the office of farm practice; at the present time the major part of the work of that office is the study of farm practice. That study is not a superficial study, but it is a serious attempt to formulate important principles from the experience of farmers. In most cases each man takes up the study of a single phase of farming. In some cases the field of study is more general.

For instance, one of our men this past season has been studying the cropping systems in vogue in certain parts of the country. He finds that there are certain farms which are preeminently successful, making large sums of money, and he gives especial attention to the cropping systems on those farms, and the methods used for maintaining the fertility of the soil. As a result of such study we are ready now in many instances to answer the inquiries of the farmer who writes to us and says, "I am running a little dairy farm in such and such a State and should like some advice about growing feed for my cows." First, we ask him about his soil, and get all the information it is possible to get from him about his conditions and equipment for work. If we do not understand his conditions we send a man to study the situation. Then, after we understand his conditions, in many cases we do not hesitate to formulate a cropping system and tell the dairyman what to grow, how much to grow, and how to feed it; and we do that.

Now, I wish that I had time to outline to you in full the work of the office of farm management. I know there is an inquiry in your minds in regard to it, and I am anxious to answer the inquiry as far as I can. And I am anxious, too, that in this work we shall be helpful to you people who are engaged in your own States in scientific investigation. I want to say this, that there is one gap in our system of investigation in this connection. It is one that is being bridged, and one that the office of farm management is intended to bridge. You all know what it meant to teach agriculture before we had experiment stations, or rather you all know it did not mean much of anything. After our experiment stations had been running five years the teaching of agriculture began to assume a meaning. That means that these experiment stations have been gathering facts that have a direct relation to the business side of farming. Now we have our experiment stations delving into nature for facts and principles, and getting them, too. The original intention was to get these facts and principles and publish them, and that is the method that has generally been adopted. We have found, as we might perhaps have reasoned out would be the case, that most of the farmers do not get their information by reading, and yet once in a while here and there is found a bright farmer, an educated man, usually one who has studied and got the lessons we have offered him. The average farmer has not done that at all, and now we need some means of bringing our lesson to the average farmer.

We must carry this information to the farmer in a way which appreciates the farmer's limitations. Here Professor Duggar and I established a farm. We planned a system of management for that farm. The farmer who owned it followed out the instructions in a very accurate manner. He got results that were astonishing, even to those of us who had planned the work. We first announced a year ago that we would hold a farmers' institute at this farm. Unfortunately, a slow train prevented me from getting to the institute, but Professor Duggar was there, and there were a thousand farmers at that institute. The crowd could not be handled, it was so big. This summer we held another institute on this farm, and instead of announcing the fact publicly we sent out 150 invitations to selected farmers, and all responded. The meeting was held in a beautiful grove on the farm, where from the platform we could see the hogs in the alfalfa field. Between us and that field the owner of the farm was building a hay barn. Formerly he had bought his hay from Ohio and Indiana and Illinois. Now he was raising more hay than he had ever raised. In my presence a local farmer offered him $20 a ton for some of that hay. He would not sell it, because he would simply have to buy more.

Those farmers sat with their mouths open for two hours and listened to the discussions of the experience on that farm. That was a farm, and not demonstration plats; and I believe that as the result of that little farm there will be many thousands of acres of alfalfa sown in that neighborhood. The danger is that we may overencourage the industry. That is a single-crop country, and whenever the farmers cut loose from cotton the tendency always is for them to rush pellmell into something else and to overdo it. I am using this as an illustration of the value of a means of getting our illustrations before the farmer. What did we do on that farm? Professor Duggar and Professor Richeson—the farm is located right by the side of the Canebrake Experiment Station—had shown previously that alfalfa would grow on that black waxy soil beautifully. We just went outside of the experiment station fence to show the farmer how to make money out of the experiment, and although they had been watching that alfalfa grow there for a long time it was only after we had demonstrated that there was money in alfalfa, and showed them how to get it out, that they did anything with it themselves. Now thousands of acres of alfalfa are being sown. That is only one illustration. I could give you others. I believe in this demonstration work. It is the work that is to fill the gap that exists in our methods of investigation and dissemination of knowledge.

C. D. Smith. Do not let us forget the newspapers as a means of dissemination. If I were asked to name the force in Michigan that is ahead of all others, I would hesitate to name any other influence before that of the rural press; and the cordial relation between the press and the station has doubled the efficiency of our work.

H. P. Armsby, of Pennsylvania. As I have listened to this extremely interesting and stimulating discussion I have been thinking of a matter which is perhaps a little aside from that which we have been considering, and yet is suggested by this: In a certain old book which we sometimes read it is written, "Woe unto you when all men speak well of you." Seriously, I think I can see a somewhat serious danger before our experiment stations on that line. Some of us know, if we only know by reading, something of the expectations that were formed when these institutions were first founded, back in the sixties, and we know something, also, of the disappointment which those expectations met with and of the sort of "middle ages" which ensued, when the agricultural colleges were in a good deal of disrepute, when they lost the confidence of the farmer, very largely because he had been led to form exaggerated expectations of what they could do for him. Now, the experiment stations have been gradually building up and securing the confidence of the farmers of the country, and I fear we are coming now into much the same position as the colleges were in originally, where the farmers expect almost everything of the station, and I think perhaps some of our friends have been a little injudicious in what they have said about the station; I think perhaps they have exaggerated what the stations have accomplished. They say that the stations are digging out the fundamental principles of agricultural science and building up materials for the instruction of the colleges; and so they are. But it is easy, I think, to exaggerate the actual contribution that the agricultural experiment stations have made thus far to agricultural science. I do not mean to belittle it, but it is easy to exaggerate it and its influence on the farmers of the country. I do not mean by this to throw cold water on this investigation work or demonstration work; but I [illegible] should bear this in mind, that we should not lead the farmer to [illegible] millenium is coming in the near future, or has come [illegible] to foster in the mind of the farmer the idea that [illegible] and college are the two crutches on whose [illegible] world. The one thing, it seems to me, wh[illegible] cultural college call upon the farmer for is, not less thought, but more. It seems to me that unless we teach him to think for himself, to work out his own problems, with our help where we can help him; that unless we set him to thinking for himself and working out his own problems and applying the principles, we are not doing him the real service that we ought to. I throw that out as a suggestion.

W. H. **Jordan.** I would like to emphasize, if I am able to do so, what Professor Armsby has just said. I have said many times in my life that there is danger of trying to do too much for the farmer, and giving him a slant of mind that leads him to think that he is dependent upon some other agency than himself for his success.

To revert a little to what advice we may give: Not long since a group of gentlemen interested in a large agricultural operation, namely, gentlemen who were producing crops which they themselves were canning in factories owned by themselves, called on me and my associates for advice. In the first place, they wished to purchase the materials and make their own fertilizers. There were some very definite things that could be said to them about that, and I sat down with them and spent an hour talking about that side of their work. They proposed to raise large areas of beans, and the question of disease was a possibility; and I sent them to the plant pathologist of the experiment station. They were having certain troubles in their canning operations, and I sent them to the bacteriologist. There were certain other problems in their work, and I sent them to the experts of the station having knowledge of them. I believe that in doing that we have done pretty nearly all that it is possible to do for that body of men. It still remained for them to take the facts given by our experts and coordinate them into their system of business, and I doubt whether with any man you can go much further than that. His temperament, his peculiar environment, which you must study in great detail before you can advise him definitely, are factors which must enter into your calculations; and even if you had a farm economist—and I wish there was one attached to each station for work along that line—he would have his limitations in regard to what a man can do in his business.

W. J. **Spillman.** I appreciate very fully the force of the suggestions that Professor Armsby and Doctor Jordan have just made. We can divide farmers into three classes, one consisting of those who have the idea that the experiment station is a theoretical sort of thing that has nothing for him, and that class is pretty numerous in all parts of the country. Another is a large class, consisting of those who never heard of the experiment station, and this class is more numerous than we think. Then there is another class of farmers who have a very exaggerated idea of the importance of the station for them, or rather an exaggerated idea of what the station can do for them. I agree with the suggestion that it is not well to encourage too great expectations. At the same time, by a conservative man, who is a farm economist, who has made a special study of types of farming and systems of farm management, it is easy to be of enormous service to the farmer. Now, it is my judgment that we can do more to increase our agricultural products and the results of the work of the farmer by giving attention to the cropping system, the system of management, the business methods of the farm, and improving them, than we can in any other immediate way.

At the risk of trespassing on your patience, I want to give you just one more
ation. Down in Georgia there is a dairy farm of 135 acres of land, with
and the necessary young stock—high-grade cows, some of them making
s of butter a year. This farm is owned and managed by the cashier
man who could give me the cost, down to a cent, of everything;
ccurate a set of books on his farm as he did for the bank. The

gross income for the year before had been $41 per acre. His net income was $23 an acre. His management of his cows I considered to be ideal, and, although I am a dairy farmer, I was not able to think of any improvements he could make in his system of managing his cows. But I found that man utilizing two-thirds of his land for four months in the year growing crops for his cows. It is true that he was growing phenomenally large crops, but he was utilizing only two-thirds of his land for four months of each year for growing feed. On the other third he was growing straw for bedding. We have made ourselves familiar with the possibilities of farming in that section, and it was plain that he was using a poor cropping system. We suggested a better system. He said nothing. He was a conservative, careful, thinking man. Three weeks later we received a letter from him asking us to outline that system on paper. This was done. About a month later he wrote again, saying: " I have decided to adopt the system you have suggested in full, and you are invited to make suggestions upon any feature of my farming at any time a suggestion occurs to you." He has that system now about half in operation. The gross income has been raised the first year from $41 to $67 per acre as the result of an improved cropping system.

Now, the point I want to make is this: That while there is danger, and I realize it as fully as any of you, of getting the farmer to rely too much upon us, there is an opportunity which is unexcelled of improving agricultural practice in this country by studying the farmer and his immediate problems, and making recommendations where we understand the conditions.

We get letters from hundreds of farmers—we have gotten as many as 50 of these letters in two days—asking us to plan cropping systems. To most of those letters we reply, " We can not help you; we do not know your local conditions." But many of them come from sections where we do know the conditions, and when such is the case we give the information. There are many instances where this information has been utilized in largely increasing the income of the farm. I believe it is possible, by putting enough men on work of this kind, to increase very materially the product of the land in this country, by aiding the farmer to utilize what you men have already discovered and what other farmers have discovered. Of course it is difficult to prophesy, but I think it is possible to double the agricultural products of this country by that means. Now, it may be assuming too much responsibility, but I believe we are justified in doing it. It is true it calls for conservatism. It is true that in this work we are advertising your work. We are teaching people to believe great things of you, and we may be doing some harm along with the good we do.

W. R. Dodson, of Louisiana, for the programme committee, recommended that the subject for discussion by the next convention be "Animal nutrition," and that the committee on that programme be H. P. Armsby, C. F. Curtiss, and the secretary.

The recommendation was approved, and the programme committee named was instructed to select a second topic.

Thereupon the section adjourned sine die.

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THE AGRICULTURAL EXPERIMENT STATIONS.

Alabama—
  College Station: *Auburn*; J. F. Duggar.[b]
  Canebrake Station: *Uniontown*; J. M. Richeson.[b]
  Tuskegee Station: *Tuskegee*; G. W. Carver.[a]
Alaska—*Sitka*: C. C. Georgeson.[c]
Arizona—*Tucson*: R. H. Forbes.[d]
Arkansas—*Fayetteville*: W. G. Vincenheller.[a]
California—*Berkeley*: E. J. Wickson.[d]
Colorado—*Fort Collins*: L. G. Carpenter.[a]
Connecticut—
  State Station: *New Haven*; E. H. Jenkins.[a]
  Storrs Station: *Storrs*; L. A. Clinton.[a]
Delaware—*Newark*: A. T. Neale.[a]
Florida—*Lake City*: P. H. Rolfs.[a]
Georgia—*Experiment*: R. J. Redding.[a]
Hawaii—
  Federal Station: *Honolulu*; J. G. Smith.[c]
  Sugar Planters' Station: *Honolulu*; C. F. Eckart.[a]
Idaho—*Moscow*: H. T. French.[a]
Illinois—*Urbana*: E. Davenport.[a]
Indiana—*Lafayette*: A. Goss.[a]
Iowa—*Ames*: C. F. Curtiss.[a]
Kansas—*Manhattan*: J. T. Willard.[d]
Kentucky—*Lexington*: M. A. Scovell.[a]
Louisiana—
  State Station: *Baton Rouge*.
  Sugar Station: *Audubon Park, New Orleans*.
  North Louisiana Station: *Calhoun*; W. R. Dodson.[a]
Maine—*Orono*: C. D. Woods.[a]
Maryland—*College Park*: H. J. Patterson.[a]
Massachusetts—*Amherst*: W. P. Brooks.[a]
Michigan—*Agricultural College*: C. D. Smith.[a]
Minnesota—*St. Anthony Park, St. Paul*: W. M. Liggett.[a]
Mississippi—*Agricultural College*: W. L. Hutchinson.[a]
Missouri—
  College Station: *Columbia*; H. J. Waters.[a]
  Fruit Station: *Mountain Grove*; P. Evans.[a]
Montana—*Bozeman*: F. B. Linfield.[a]
Nebraska—*Lincoln*: E. A. Burnett.[a]
Nevada—*Reno*: N. E. Wilson.[d]
New Hampshire—*Durham*: W. D. Gibbs.[a]
New Jersey—*New Brunswick*: E. B. Voorhees.[a]
New Mexico—*Agricultural College*: L. Foster.[a]
New York—
  State Station: *Geneva*; W. H. Jordan.[a]
  Cornell Station: *Ithaca*; L. H. Bailey.[a]
North Carolina—*Raleigh*: B. W. Kilgore.[a]
North Dakota—*Agricultural College*: J. H. Worst.[a]
Ohio—*Wooster*: C. E. Thorne.[a]
Oklahoma—*Stillwater*: J. Fields.[a]
Oregon—*Corvallis*: J. Withycombe.[a]
Pennsylvania—*State College*: H. P. Armsby.[a]
Porto Rico—*Mayaguez*: D. W. May.[c]
Rhode Island—*Kingston*: H. J. Wheeler.[a]
South Carolina—*Clemson College*: J. N. Harper.[a]
South Dakota—*Brookings*: J. W. Wilson.[a]
Tennessee—*Knoxville*: H. A. Morgan.[a]
Texas—*College Station*: John A. Craig.[a]
Utah—*Logan*: P. A. Yoder.[a]
Vermont—*Burlington*: J. L. Hills.[a]
Virginia—*Blacksburg*: A. M. Soule.[a]
Washington—*Pullman*: E. A. Bryan.[a]
West Virginia—*Morgantown*: J. H. Stewart.[a]
Wisconsin—*Madison*: W. A. Henry.[a]
Wyoming—*Laramie*: B. C. Buffum.[a]

[a] Director. [b] Assistant director. [c] Special agent in charge. [d] Acting director.